HELSINKI SCHOOL OF ECONOMICS (HSE)
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Shared Information Technology and Trust in Supply Chain

Information Systems Science
Master's thesis
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Spring 2006

Approved by the Head of the Department of Business Technology 24/5 2006, and awarded the grade good, top.

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Abstract

Trust and inter-organizational information systems have received limited attention in prior research. This study combines both trust research and information systems research into an inquiry into: "How trust affects utilization of shared information technology in Supply Chain?" Study is conducted as a case study of two companies comprising both ends of the dyadic relationship. Both case companies are medium sized industrial companies that have implemented interorganizational information systems between themselves three years ago. Their actual business relationship is approximately ten years old.

Theoretical basis of study is a combination of trust research, transaction cost theory and a mix of organizational theories. Case study was conducted during 2005. Case study was based on interviews of case companies' representatives who were responsible for relationship. Interview was a form of active interview where respondent could freely express themselves. Interview questions were semi structured where interviewer asked key questions and then allowed respondent to elaborate freely.

Research results indicated that study's framework is valid and that trust and information technology can contribute into each others improvement.

Keywords: trust, interorganizational information system, shared IT, transaction cost economics

Tiivistelmä

Luottamus ja organisaatioiden väliset tietojärjestelmät ovat saaneet rajoitetusti huomiota aikaisemmassa tutkimuksessa. Tämä tutkimus yhdistää sekä luottamus että tietojärjestelmätieteen tutkimuksen kysymykseen siitä että, "Kuinka luottamus vaikuttaa jaettujen tietojärjestelmien käyttöön jakeluketjussa?" Tutkimus on toteutettu case tutkimuksena ja liikesuhteen molemmat päät ovat mukana tutkimuksessa. Molemmat case yritykset ovat keskisuuria teollisuusyrityksiä, jotka ovat toteuttaneet organisaatioiden välisen tietojärjestelmän välilleen 3 vuotta sitten. Yritysten liikesuhde on noin 10 vuotta vanha.

Tutkimuksen teoria perustuu luottamustutkimukseen, transaktiokustannusteoriaan ja organisaatioteorioihin. Case tutkimus toteutettiin 2005. Case tutkimuksessa haastateltiin yritysten edustajia, jotka olivat vastuussa liikesuhteesta. Haastattelussa oli runko jonka pohjalta haastateltavat vastasivat kysymyksiin vapaasti.

Tutkimus tuloksena saatiin, että tutkimuksen teoreettinen perusta pitää paikkansa ja että luottamus ja informaatio teknologia voivat vaikuttaa positiivisesti toisiinsa.

Avainsanat: luottamus, organisaatioiden väliset tietojärjestelmät, jaettu tietotekniikka, transaktiokustannus teoria

Contents

Table of Figures

Table of Tables

1 Introduction

Information technology today is utilized widely in companies. Use has expanded radically during last decade both inside and between companies. Information technology has finally reached levels where computing power is no longer bottle neck. However, as always bottle necks do not disappear, they move into new places. Current trends in information technology are increasing role of various forms of virtualization technologies (www.vmware.com) and relative abundance of hardware resources and radical reduction of software costs (for example open source). Interorganizational information systems have become increasingly important. The complexity of interorganizational systems is far greater than systems that only reside in one organization. Interorganizational coordination of information systems remains very difficult and expensive. This is due to many reasons. In this study we shed more light to one issue that has remained in relative darkness: the use of trust as a coordination mechanism. Coordination of complex systems is and is going to be very important because the scale of information systems is constantly increasing. These vast heterogeneous networks of machines and organisms have to be coordinated someway. This presents new challenge to information systems science and one feasible coordination mechanisms that has often been overlooked is trust.

This research studies trust between companies and the role of shared information technology in their relationship. Trust is first examined from the perspective of prior research. Trust has received considerable amount of interest from researchers from multitude of perspectives, research traditions and philosophies. In this study, trust is mainly seen from the perspective of business relationship between companies. In this view, the trust is located in relationship between decision makers, in their attitudes and feelings. Part of trust is coded into business practices and into information systems. Trust exists in information systems in how they are arranged and how relationships are coded into system architecture. These coded relationships exist in logistical supply chains as well. Trust is coded into how companies approach each other and how they deal with each other in daily business operations. Even though, shared information technology carries and is part of these transactions between companies, computers are not trusted as computational systems, rather they are seen as being part of exchange processes that create and maintain trustful relationships in business context. In this study, it is not assumed that computers (and related equipment and

software) are trusted as computational objects, rather they are trusted as carries of trust signals that are exchanged between companies (and individual participants in trust creation process).

1.1 Research Question

Research studies relationship between trust and interorganizational information systems. Especially under inspection is how trust affects utilization of shared information technology between two industrial companies. The causality of relationship is not directly under investigation. In this study, trust is assumed to be autopoietic concept. Hence, causality is omitted because autopoietic systems are strongly connected and causal relationships become fuzzy. In autopoietic systems it is difficult to observe simple causal relationships.

The relationship between trust and shared information technology is not strong and easily observable. The relationship is "soft" and "fuzzy", more like soft wind in the grass than heavy snowstorm. Many researchers still consider trust with disrespect due to the fact that it is difficult to define and one can even question its existence altogether. Trust is a concept full of vagueness. It is also a concept that can fade away under intense scrutiny.

Research questions are divided into two groups. Main research question forms both the theoretical and empirical part and two sub-research questions are utilized to produce necessary theoretical basis.

In short, main research question is:

How trust affects utilization of shared information technology in Supply Chain?

In order to develop necessary theory, it is necessary to develop meaningful understanding of trust and this is facilitated by studying trust at theoretical level. Hence, study contains two sub-research questions, which are:

What is trust (literature review only)?
What are information technologies that facilitate information sharing (literature review only)?

1.2 Definitions

Forms of governance=in this study forms of governance are market, hierarchy, and network.

Integration=in the context of business relationship, vertical integration means that companies (or parts of companies) are under one owner (or at least that the arrangement can be considered as effectively achieving similar rights with full ownership through contractual means).

Interorganizational information systems=Interorganizational information systems and shared information technology are similar concepts. However, system and technology is not the same thing. Technology emphasizes technological aspects and systems emphasize system related issues. Organizational practices can be part of system, when they are rarely part of actual information technology. However, due to nature of interconnectedness of concepts, one cannot fully consider technology without organizational forms. Business technology rarely, if ever, exists without organization that needs it. This obviously forces technology to adopt forms that are subservient to the needs of it uses.

Organism=similar with organization but emphasizes similarity with biological systems.

Pure market=is a highly idealized market. It has large number of both buyers and sellers, and all relevant information is also contained in market price. Neither buyer nor seller can do nothing to change market outcome. This is a theoretical concept and it does not exist in real world except in text books that are given to unsuspecting students of economics.

Relationship spectrum=relationships from market transactions into full vertical integration. Market transactions here are conducted assuming perfect markets. Vertical integration means the existence of full hierarchical control structure with necessary mechanisms to force obedience.

Relationship=relationships start from pure market based and extend up into full vertical integration (hierarchy).

Shared information technology=information technology that is used between companies in supply chain.

Trust = trust is the value that partners in a relationship place on it. This value depends on how partners see each others' contribution to their success. Trust also contains interpersonal, intrapersonal and company wide and wider corporate network dimensions. Also how third parties perceive trusted party affects the value of trust. Trust is also affected by the strategy of companies in question. The level of relationship that can be built between trusted parties is affected by their corporate strategies, visions, and dreams. In short, trust capitalizes the relationship.

1.3 Structure of the Study

Study starts with general discussion on trust and how it exists in organization, and how people perceive it. Different forms of trust are then discussed. Trust is divided into four components, namely capability, goodwill, behavior, and self-reference. After considering different components of trust, the time dimension of trust is also examined.

After discussion on trust, information technology and trust are introduced to reader in order develop basic understanding of its role in supply chain. Supply chain view is then enlarged to encompass broader network issues and finally the concept of autopoiesis and complexity are presented to reader. After this, study's framework is presented. Then reader is made aware of used research methodologies and finally reader is presented with case results and conclusions.

2 Trust in Supply Chain Network

2.1 Meaning of Trust

Trust has many definitions in literature. Blomqvist (1997) has collected various definitions from sociology, philosophy and economy. In sociology, trust is seen as willingness to enter into potentially vulnerable position relative to another while possessing knowledge that allows one to trust other. Philosophers see trust in many different ways. Philosophers may see trust as absolute like trust in God or in Marxism. Or they may consider trust in the context of strangers meeting each other or in long term relationship. Economists have been far less creative in their approach to trust. Traditionally, they have not paid much attention to trust in market exchange. However, this has changed when economists have shifted their attention from perfect markets to imperfect markets. (Blomqvist, 1997, p. 272-273) Recently trust research has garnered interest even from construction industry where insights from trust research are being applied to improve companies working relationships and their performance. (www.scpm.salford.ac.uk/trust/index.html, Swan, 2003) Soliman and Janz (2004) have studied critical factors that affect the decision to establish Internet based interorganizational information systems. They found evidence to support the view that trust plays an important role in adoption decision. (Soliman & Janz, 2004, p.703)

Trust can be seen at societal level, between organizations, at organizational, and at individual level. (See Borgatti & Foster, 2003 for many uses of social capital) Trust can also be a property of individual, property of social relationship or a kind of social organization. (Lewis & Weigert, 1985) Social capital also is closely associated with trust. In addition, trust has been studied extensively at personal level. Considerable amount of research exists that have studied trust at personal romantic relationships (Zuroff & Fitzpatrick, 1995) Trust can also be examined as a trait of leadership. It can be observed to have different dimensions depending on orgazational level and role. This is especially true for persons acting in leadership positions in management. (Joni, 2004) It is also important to consider that, when examining companies relationships people in them also have positions and dependencies. These goals are likely to conflict as a result of high number of both internal and external relationships between people and companies. This is most likely true at higher levels in management because of greater and more advanced networks.

Organizations and their relationships is not the same thing as relationships between people. Organizations are in their relationships profit maximizers. Long term approach to relationship helps into trust creation process (Jarillo, 1988, p. 37). Short term approach to business is conducive for opportunistic behavior that destroys trust. (Jarillo & Stevenson, 1991, p.68-71)

Trust allows companies to extend their networks over what could be achieved without trust. This allows companies to focus more into their core competencies instead of acquiring all necessary assets and competencies themselves; they can tap other companies' resources. Moreover, companies that focus on their core competencies find that they have to look for complementary assets, resources and knowledge inside other companies. They have to access these resources through their networks. Trust facilitates this behavior. Trust allows companies to negotiate contracts easier because they do not have to make complete contracts because they can "trust" each other that the other party behaves in ways that is beneficial to both parties (Child, 2001, p.278, Jarillo, 1988, p. 35-36, Thorelli, 1986, p.38, Jarillo & Stevenson, 1991, p.68-71, Ebers & Jarillo, 1998, p. 5). Trust also facilitates ongoing relationship and allows companies to deepen them. (Jarillo & Stevenson, 1991, p.69) However, it can be argued that trust does not exist between companies. Cousins (2002, p. 71) argues that partnership relationships do not exist between organizations. Rather, there are different shades of collaborative relationships that are all competitive. He argues that organizations do not trust each other; rather they manage risk based on business case decisions. Moreover, Cousins (2002, p. 80-81) sees trust not as a relationship, rather as a process. (Cousins, 2002, p. 71, see also Jarillo & Stevenson, 1991, p.69) Industrial network approach handles trust more as an asset rather than as a process. (Cousins, 2002, p.76) This difference may sound more as semantic but it emphasizes totally different aspect of trust and relationship. There exist considerable amount of literature that considers trust as something that can be compared with other capitalized assets. This so called social capital literature emphasizes trust phenomenon's static dimension where as process view regards trust as constantly evolving concept that is exchanged between companies.

Trust has received considerable interest in research setting for decades. First interest centered for its' importance in personal relationships. According to Svensson (2001), trust research in business setting has been considerable. However, it has rarely been extended farther than issues concerning dyadic business relationship. Trust research has mainly emphasized unidirectional, bidirectional and direct trust issues in dyadic business relationships. (Svensson, 2001, p. 431) Moreover, trust is a substantial dimension in the interaction and network approach (see Håkansson, 1982 and

Håkansson & Snehota, 1995) and in services marketing (see Grönroos, 1990). Moreover, it is a basic feature in relationship marketing (see Morgan and Hunt, 1994).

Svensson (2001, p.432) has classified trust relationship research in two dimensions in supply chain. He considers both up- and downstream directions. The existence of trust affects business relationship between companies. It is totally different situation, if supply chain parties trust to each other mutually, than where there is no trust at all. (Svensson, 2001, p. 432) Moreover, especially, in network contexts, trust is important. Networks enable network members to access easily other companies' resources without employing specialists or without investments into internal capacity (Lincoln et al., 1998, p.241)

In organizational context, trust can be seen both between individuals and organizations. At individual level trust can be divided into two dimensions: emotional and rational. These dimensions allow us to classify different types of trust. These classifications are presented in figure 1. (Lewis & Weigert, 1985, p. 972-974) When individuals and organizations trust each other, it makes information exchange more efficient. Quality of information exchange is also affected by compatibility of each others' concepts. (Kidd et al., p. 604-605) Trust act on both interpersonal and inter-organizational level. However, according to Blomqvist and Ståhle it is always the people that trust each other and not the organizations. (Blomqvist & Ståhle, 2000, p. 4). However, the idea that people trust each other rather than something else is not universally accepted as truth. People also trust brands and they often transfer emotional bonds to inanimate objects. People even trust abstract entities like Gods. Many people regard persons in Television as their personal friends and they often regard them as their family members even though they do not have any "real" relationship. Moreover, sometimes people transfer to humans' feelings and expectations that are of supernatural origin. Then they regard these people as symbols of something bigger than man (For example Stalin, Hitler and Mao). Many people also believe and trust in abstract theories and ideologies that they do not even understand (Communism, Capitalism, Conservatism etc.). Hence, human behavior is very multifaceted and fascinating. Humans do not behave like rational machines. They are something very different and this means that in order to understand human experience and behavior we have to accept that humans are not rational beings.

Rationality	Emotionality: High	Emotionality: Low	Emotionality: Virtually absent
High	Ideological Trust	Cognitive Trust	Rational Prediction
Low	Emotional Trust	Mundane, Routine Trust	Probable Anticipation
Virtually absent	Faith	Fate	Uncertainty, Panic

Figure 1. Rationality and Emotionality Bases, Types of Trust and Boundary States
(Lewis & Weigert, 1985, p. 973)

Blomqvist & Ståhle (2000, p. 3) divide trust into three components behavior, goodwill and competence. This division is similar to what was developed by Sako (1990). Sako defines trust with three concepts Contractual trust, Goodwill Trust and Competence Trust. (Sako, 1990) Behavior means how parties actually behave toward each other. Signs of goodwill mean moral responsibility and positive intentions toward the other party. This is especially true when parties are entering into relationship where they are vulnerable to each others actions. Positive signs appear as signs of co-operation and that the other party takes into account the other party's position. (Blomqvist & Ståhle, 2000, p. 3) In her doctoral dissertation, Blomqvist (2002, p.173-183) added self-reference into this list. These are explained in figure 2.

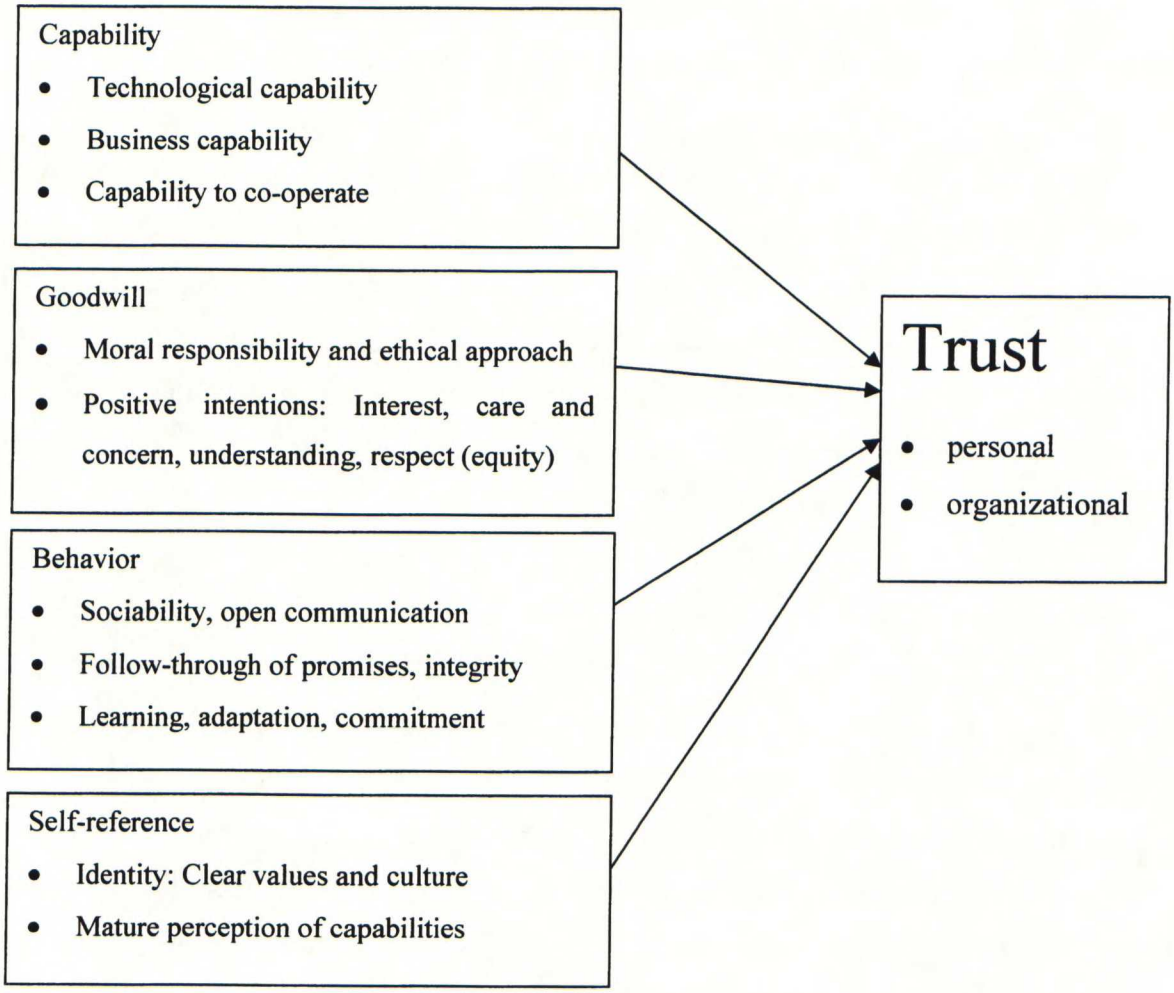

Figure 2. Components of Trust
(Blomqvist, 2002)

Blomqvist (2002) studied in her doctoral dissertation how small and large companies can partner in fast changing technology business where nothing is for certain. She considers that capability has to exist before trust can be created in the first place. Capability refers to technological capability, business capability and meta-capability to co-operate. (Blomqvist, 2002, p.175-176) In her dissertation, technological capability was very important because she studied how large companies develop their technological capabilities by using small companies as a source of highly specialized technological knowledge.

Goodwill means how parties to relationship perceive each others willingness to co-operate in ethical fashion. Goodwill is how trustor perceives trustee's willingness to behave toward trustor. This means that trustee is willing to avoid opportunistic actions that might harm trustor. Goodwill also indicates trustee's willingness to honor commonly accepted behavioral standards and norms.

Goodwill can be divided further into moral responsibility, interest, care and concern, understanding and respect, and positive intentions. (Blomqvist, 2002, p. 176-177)

Behavior means the way company behaves. All interaction between companies sends signals. The persons involved in interaction then interpret these signals and produce mental models that allow them to assess how they perceive the trustworthiness of the other company. Communication plays an important role here in the transmission of intentions that companies have for each other. The persons involved in communication process between companies interpret sent messages either consciously or unconsciously and then make necessary adjustments in their assessment of other party's trustworthiness. (Blomqvist, 2002, p. 178-179)

Self reference, according to Blomqvist (2002), originates from Luhmann's work. Self-referential system is capable of distinguishing itself and environment. Human beings are self-referential systems. This means that the system becomes aware of its identity and capabilities in relation to others. (Blomqvist, 2002, p. 179; Luhmann, 1995, cited in Blomqvist, 2002, p. 179) Self-reference enables person to relate with other people at equal level in order to learn from and with them and this allows person to renew and develop himself. (Blomqvist, 2002, p. 179) According to Morgan (1997, p. 253) the concept of autopoiesis uses the concept of self-reference. Autopoiesis (Whitaker, 2004) sees organization as self referential system that is actually closed and not as open to environment. Environment cannot be separated from organization, because it is so tightly integrated into its' environment that the concept of environment and organization as independent objects make no sense. The distinction of environment and organization would destroy circular reference cycles that maintain the organization. However, Blomqvist does not use autopoietic framework in her work and her trust framework seems not to be autopoietic, because she makes distinctions between organization and environment. Autopoiesis is a very interesting philosophy that tries to explain world with the aid of system thinking. Moreover, autopoiesis is part of cybernetics (Principia Cybernetica Web).

2.2 Process of Trust

Trust between organizations has also time dimension. Trust evolves over time. Trust between organizations and persons may increase, decrease or remain the same. Trust has a very strong

feedback loop where trust creates trust. Trust is also coupled to other feedback loops inside company. Thorough discussion of feedback loops and their meaning to companies can be found in Sterman (2000, p.231-512). Human mind (brain) also is part of the system. It is not in anyway dominant; it is merely part of the system. Trust exists in human brain, in contacts between people and in organizational symbols and artifacts. Trust is created through exchange of symbols (either material or immaterial). Trust has many layers and many dimensions (including time).

According to Child (2001) trust between organizations evolves in phases. First companies start with calculative trust. This form of trust is based on estimated benefits and risks that parties to relationship expect from it. The second stage is trust based on mutual understanding. In this trust form, companies have historical experience from other party and that they have honored their promises. The risk in initial stage of calculative trust is reduced through experience and knowledge of other party's behavior. Child especially mentions that information systems that are initially implemented to support the relationship are very important for continual improvement of trust in relationship. Trust in relationship improves by both parties having access to relevant knowledge concerning relationship. In the creation of trust, knowledge of what is happening between companies plays pivotal role in trust creation. Third evolution in trust process is trust based on bonding. In this phase, trust between organizations becomes stronger and more personal. Companies share common values, including moral obligation to each other. This phase of process is mainly maintained through interpersonal contacts. (Child, 2001, p. 279-281, Jarillo & Stevenson, 1991, p.69)

2.3 Information Technology and Trust

Computer Mediated Communication (CMC) supports interaction between people. Computer mediated interactions carry increased risk of misunderstanding. Users might come from different contexts or cultures and these differences increase the risk that users are not capable of accurately communicating their intentions. As these risks increase, users of collaborative technologies face more complex decisions. Trust allows users to reduce complexity. Furthermore, successful CMC needs greater amount of trust than face to face interaction. (Riegelsberger et al., 2003, p. 759) This is because CMCs' reduce signals that people can use for bonding at personal level (like facial cues).

Annen (2003, p. 457) writes on the creation and maintenance of social capital that creation and maintenance of social capital are dependent on communication. The better communication capabilities you have, the better possibilities you have for creation of social capital. Especially, he argues that information technology can facilitate and improve communication between social groups. (Annen, 2003, p.457) Social capital is strongly related with trust in a sense that when social capital is high; people tend to trust more to each other. Moreover, information technology, especially groupware can be used to keep cross functional teams aware of the business situation (Thierauf, 2001, p. 75). This allows team members to gradually develop trust from calculative trust and then gradually deepen their trust capital.

2.4 Value of Information in Supply Chain and Trust

Tan (2001) has made a literature review of supply chain literature. According to him, supply chain literature has evolved from emphasis in mass production through JIT (Just In Time) into current understanding which emphasis coordination between companies. Coordination allows companies to achieve competitive advantage. (Tan, 2001, p. 40-41) Better information makes co-operation in networks more economic and this contributes to the use of more network centric strategies. (Jarillo & Stevenson, 1991, p. 68) Co-operational strategies need trust in order to succeed.

Information allows companies to better coordinate their operations. And information, especially demand information can act as a substitute to inventory. (Milgrom & Roberts, 1988, p.276) The collection, distribution and utilization of information can greatly be improved by intensive use of information technology. Trust and information are similar at least in the sense that both are immaterial. Furthermore, companies need to trust each other at least to some extent in order to reveal information concerning their respective supply levels. Also companies need to share information concerning their goals and operations in order to better coordinate their actions. This coordination can at best benefit both parties but at least minimum level (threshold level) of trust has to be present before sharing of information can happen. Threshold level of trust varies and it is asymmetric, meaning that it does not have to be the same level into both directions. Threshold level of trust has to be exceeded before any meaningful co-operation can take place.

3 Network, Knowledge, and Information Systems

Trust does not exist in vacuum. It is surrounded by various artifacts. Many of these artifacts are symbolical presentations of reality. This chapter reviews many important concepts/symbolic presentations of reality that are important for this study. Chapter 3.1: Firm, Network and Knowledge, discusses knowledge management and its contributions to present study. Trust is somewhat similar to knowledge in many senses. The obvious is that it is immaterial. It is also created in exchange process and it evolves over time. Knowledge is social, trust is also. And trust is also knowledge and knowledge is trust. In chapter 3.2: Comparison of Trust with other forms of Governance, trust is compared with other ways of controlling relationships.

In this study, trust is facilitated with interorganizational information technology, and these are discussed in chapter 3.3: Information Systems and Supply Chain where industrial supply chains and their use of information technology are under review. This is again contrasted with industrial network perspective, which again has similarities with trust. Networks are also forms of governance structures. They are not dyadic, as is the case with trust in this study, but relationship between companies are at a higher level of abstraction also nodes of network. After network, complexity naturally evolves out of chaos (Chapter 3.5: Autopoiesis,Complexity and Chaos). Chaos is a weird phenomenon of nature, it means structure in chaos inside complex world, and you have order. Out of chaos emerges a pattern of structure; and chaotic process is no longer completely unpredictable as one might expect. Trust is not a physical being; it lives in eternally chaotic world of dreams and abstractions, in mirror world of our "real" existence. This mirror world may sometimes be more real than so called "real" world. Trust is somewhat autopoietic in that it creates itself in continues loop. These loops can also control real processes, and especially bring order by creating feedback loops between companies. Feedback loops are according to system theory, the most efficient way of implementing control structures between systems. Trust can be thought out as implementing feedback loop. These trust feedback loops are similar to market transactions that they also carry information considering how successful company's product offering is. Success may lead into deeper forms of relationship and this again may mean greater sales. Success creates success and trust creates trust. Finally in chapter 3.6: Intensity of Information Technology Use presents the fact that intensity of use of computing resources has grown considerably during recent decades. This is a

fact that has to be taken into consideration when evaluating increases in information technology use.

3.1 Firm, Network and Knowledge

Our society is increasingly knowledge intensive. (Nonaka, 1994, p. 14) In the knowledge-based competition, the firm's capabilities cannot be seen only in terms of its products or services but more likely as a social phenomenon. (Blomqvist & Seppänen, 2003, p. 2) Knowledge can act as a key differentiator between companies and it can increase efficiency both in manufacturing and in supply chain. (Krogh et al., 2001, p.422) Nonaka and Konno (1998, p. 46) discusses knowledge creation. They consider knowledge creation to be a spiral that is moving in cyclical fashion in phases. The spiral is composed of 4 phases that are socialization, externalization, internalization and combination. These happen at different organizational level. Considerable amount of knowledge exists in customer interface where it has to be transferred and transcended to other parts of network. Open organization design and stimulation at customer interface provides strong ecological stimuli through direct encounter between individuals. Furthermore, Nonaka and Konno (p. 46, 1998) emphasize that from this emerges care, love, trust and commitment. (Nonaka, 1998) It is important that there is a dialogue between tacit and explicit knowledge. However, if participants to knowledge creation lack commitment at a personal level, it might mean that the spiral of organizational knowledge creation reduces itself into superficial interpretation of existing knowledge. (Nonaka, 1994, p.7)

Knowledge creation is a cyclical process that uses previous phases of cycle as inputs to next phase. Learning organization tradition has similar concepts. Learning organization tradition uses organizational learning cycle with addition with individual learning cycle where employee learns in his work and from shared experience emerges learning at organizational level (Dixon, 1994, p.46). Knowledge management and organizational learning share similar concepts and approaches.

Nonaka and Konno use the concept ba as a synonym for knowledge. They also discuss how ba (Cyber ba) can exist in virtual world as well as in real world. They consider that it represents the combination phase. They write that this phase is most efficiently supported in collaborative environments utilizing information technology. (Nonaka & Konno, 1998) In addition, information technology can be utilized to leverage knowledge domains in and between companies. Community

software can allow organizational members to both organize and maintain their community interaction across geographical boundaries and time zones at very low cost. (Krogh et al., 2001, p.429)

3.2 Comparison of Trust with other forms of Governance

During late last century, companies in the USA moved away from rigid strongly vertically integrated companies into more flexible network like organization structures. Whereas vertical companies were managed by layers and layers of management and hierarchy, the new networks of companies emphasized partnerships between companies, multiple types of ownership and partnering within organization, teamwork among the members of organization and often from different co-operating companies. (Webster, 1992, p. 3-4)

On market form of organizing economic activity, all activity is based on discrete market based transactions that are all independent of each other. Moreover, practically all information that is exchanged between companies is contained in market price. (Webster, 1992, p. 5) In addition to these costs, companies have to find out prices, negotiate contract and monitor supplier performance. Traditionally, companies' relationships have been adversarial. Their effort has focused on lowering price. However, many companies are moving away adversarial relationships, into relationships that emphasize co-operation. (Webster, 1992, p. 5-7) Jarillo and Stevenson (1991, p. 68) also highlight transaction cost economics in network settings because the network is a function of transactions costs, the cost of internal versus external productions' scale efficiencies, economies of specialization and risk that is involved in relationship. Jarillo (1991) in answer to critique of using transaction cost economics as a basis of his research in networks explains why transaction cost economics is relevant for network relationships even though it can be argued that it applies only to dyadic relationships. He asserts that networks can emerge as most efficient form of governance over the long range in competitive markets. (Jarillo, 1991, p.497-498) Jarillo explains why networks can emerge as a response in competitive markets:

"Sometimes companies in networks may achieve uncommon lowering of the natural transaction costs' which allows them, if it is more efficient to carry out activities in separate firms, to do so without the hindrance of the "natural" transaction costs." (Jarillo, 1991, p.498)

Webster has classified 7 different kinds of relationships between companies (figure 3). Relationships start from pure market based and extend up into full vertical integration (hierarchy).

Figure 3. Range of relationships

In the middle of relationship spectrum, we have relationships that are hybrids in transaction cost economics. Hybrid relationships are best when factors affecting market and vertical integration both pull into different directions. In hybrid forms, trust becomes an important consideration in the coordination of relationship. This is because in pure transactions that are executed in market very little trust is needed because the market mechanism itself governs the transaction. One may view this situation as that the trust of relationship is externalized to market mechanism that is governed by laws. The legal system implements necessary trust. In pure transactions, legal system forces parties to transaction to honor the contract. The legal system also offers appropriate ways to solve disputes and to punish those that are not willing to honor contracts. Also in vertical integration, the company has sufficient power to threaten parties to act in its' best interest. In extreme case, it can threaten to force offending parties to leave the organization. In these two polar opposites, little or no trust is needed to achieve good results. However, trust is needed very much in the middle where neither market nor vertical integration dominates. The market here is assumed to be perfect and highly ideal, transaction itself is also assumed to be atomic and without memory. When relationship becomes more repeated (and less "idealized"), gradually other issues become more important. The vertical integration is also assumed to be extreme in the sense that strong methods to force obedience exist. Real relationships are never like those two extremes. A good example of transaction is a transaction in currency market. Currency markets are probably as close to theoretical concept as one can go. Real relationships lie somewhere in the middle in relationship spectrum. Both in consumer and industrial markets, brands often act somewhat similar to trust. Brand can act to buyer as a proxy of how much seller can be trusted. However, in long term industrial relationships, brands play lesser role because members of relationship can relatively easily gain experiential knowledge from each other. In dyadic industrial relationship, trust is more important than brand.

In the middle of relationship spectrum companies cannot force each other to honor contracts without high costs. This forces companies to develop alternative governance structures and trust can act as a complementary form of coordination mechanism. Another perspective to this is that information technology itself can also change transaction costs. It can either decrease coordination costs in such a way that companies would start favoring more market like approaches to their relationships with their supplier or it could make more long term relationship relatively more favorable (Bakos and Brynjolfsson, 1994). Bakos (http://pages.stern.nyu.edu/~bakos/) later studies have been directed toward electronic commerce in electronic market places. This stream of research explains more how information systems affect market like approaches to organization over Internet (Bakos, 1998).

Blomqvist et al. (2000) discusses different governance structures. They relate partnerships to transaction cost economics and to different theoretical traditions. (Blomqvist et al 2000a, p 1-3) Williamson calls partnerships as hybrid and they fall between markets and vertical integration. Trust based hybrid governance structures emerge from transaction cost economics when simple game theoretical model is applied to transaction cost framework. Blomqvist et al. (2000) demonstrate how the best alternative to decision makers is to co-operate instead of non-co-operative solution. (Blomqvist et al., 2000, p.8) At best partnership may offer parties the benefits of markets and hierarchies. However, it is very challenging to manage. (Blomqvist et al., 2000, p.9) The complexity of coordinating this relationship can be reduced with the aid of advanced information technology.

3.3 Information Systems and Supply Chain

In modern supply chains, information systems are used to standardize procedures and processes. Information systems offer companies possibility to stabilize relationships by investing into relationship specific capital. (Gunnarsson, 2002, p. 258) IT can also be seen as a way of achieving efficiency in supply chain in material flows through cost rationalization (Laage-Hellman & Gadde, 1996). In addition, it can also be seen as a catalyst that facilitates and pushes new communication forms. Moreover, according to Gunnarsson and Johnson (2003), it cannot be seen just as an instrument for adding efficiency into supply chain. (Gunnarsson & Johnsson, 2003, p. 257) Boer et al. (2002) have developed a framework for assessing how electronic procurement impacts supply chain performance. Especially, considerable reductions of search and communication costs are likely. (Boer et al, 2002, p. 29-32) In addition, Barut et al. (2002) have developed a model for assessing the extent of coupling between companies in supply chain. The level of coupling in their model is divided into information extent and information intensity. Information extent refers to how far away information is shared in both up- and downstream in the supply chain. Information intensity is a function of demand, inventory, capacity and production schedules. Moreover, this is also assessed in both up- and downstream. (Barut et al, 2002, p. 162, 163, 167)

Ryssel et al. (2000) have studied how information technology affects trust and loyalty inside supply chain. They were interested how shared information technology changes relationships between companies. Shared information technology is used between suppliers and customers. In addition, it sometimes includes even competing organizations, research institutions, or consultancies. (Ryssel et al., 2000, p. 2-4)

Ryssel et al. (2000, p.15) do not find any evidence that trust affects the use of information technology between companies. Evidence from 60 German companies' shows that, the use of information technology between companies is dependent on what kind of internal information systems companies have. The atmosphere of the studied companies' relationship does not have any effect on what kind of and to what extent shared information technology is being utilized. At first this seems to validate the view that trust is not a decision variable when companies develop their relationships. However, Ryssel et al. (2000) argue in the conclusions that this is because information technology is still too young and it is not widespread enough and this causes it mainly

being utilized in innovating companies, which means that the effect of internal information systems is in ordinarily emphasized in studied companies. Furthermore, they argue that this hypothesis can explain their surprising finding that trust does not seem to have any impact on how companies use shared information technology. Moreover, information technology carries with it the risk that it impersonalizes relationships which in turn could lead into reduced trust and commitment. (Ryssel et al., 2000, p.15)

3.4 Industrial Network Perspective

Grönroos (1994, 1999, p. 327-328) argues that traditional marketing with its' emphasis to marketing mix (4P) is outdated. He sees relationship marketing as a better fit for post industrial societies where customers' basic needs have been largely satisfied and where new technology is allowing creative and novel ways to serve customer. Relationship marketing research stream started in 1970s in Nordic countries. According to Grönroos, there are two Nordic schools of thought: 1. Nordic School of Service (www.hanken.fi/mba/eng/page1658.php) and 2. IMP Group (www.impgroup.org). They both consider business as a network of companies. They both see marketing as a management issue rather than as a function and they emphasize that it is not sufficient to see business as a set of transactions. They consider that management has to base their decision on relationships rather than individual atomized transactions. (Grönroos, 1999, p.327-328)

In relationship marketing, every one becomes a marketer. These marketers that are working outside of marketing department (part time marketers) and they can outnumber personnel working inside marketing department several times. (Grönroos, 1999, p. 330-331) Furthermore, Grönroos even advocates companies to dismantle marketing department in order to emphasize that marketing belongs to everyone. (Grönroos, 1999, p. 330)

Industrial network perspective discusses industrial networks. It deemphasizes competitive aspect of strategy. This is done in order to better illustrate that companies operate in network contexts. In the field of relational strategy, a major research finding has arisen that the ability to build and maintain relations is central for corporate success. (Gadde et al., 2003, p. 2) Industry network perspective also studies networks of companies. Its' roots are in industrial district tradition. (Ebers & Jarillo, 1998, p.3) Grönroos (1994) argues that traditional view of marketing is flawed and companies

should see marketing as creation and maintenance of relationships rather than as a series of transactions that are not interrelated. This view is in contrast to the view that sees company as a nexus of contracts. These two perspectives are not exclusive in a sense that especially long term contract is also a relationship. In this sense, industrial network perspective can be seen as an extension of transaction economics. In industrial network perspective, company itself is less important and the main emphasis is given to the network that is composed of nodes that have relationships with each other.

Anderson et al. (1994) discusses in their article the nature of relationship between companies and relationship's properties in network business and how companies interact with its' environment. They clarify relationships different dimensions and how companies interact with each other in network and what are the boundaries of the network. (Anderson et al., 1994)

Håkansson and Ford (2002) explore in their article paradoxes that are in industrial networks. The first paradox deals with the fact that company is a part of the network. Well developed network allows company to use external resources. However, well developed network also ties company into its' current way of operating. This means that the first strategic issue is to identify and establish appropriate levels of involvement in its relationship with individual partners. (Håkansson and Ford, 2002, p.135-138)

The second paradox is that when company influences others, its' partners are at the same time influencing through these same relationships. The paradox is that the company is the result of the influences and their development. Thus, the company has to balance the interplay of influencing others and being influenced. (Håkansson and Ford, 2002, p.135-138)

The third paradox is that companies often try to manage their relationships in such a way that their own objectives are achieved. This means that they try to control their partners and this means that the network becomes less innovative due to constrains. In extreme case, the network transmutes itself into hierarchy instead of being network. (Håkansson and Ford, 2002, p.135-138) In addition, the existing network structure can act as a barrier to innovation because the network has invested considerable resources into existing ways of working and into relationships between nodes. (Håkansson and Ford, 2002, p.136; Håkansson, 1994) The cost of dismantling relationships between nodes may be prohibitively high and essentially locking the network into its' historical relation structure.

3.5 Autopoiesis, Complexity and Chaos

Morgan (1997, p. 251-300) discusses organizations from autopoietic and complex perspective. According to Morgan *"Traditional approaches to organization theory have been dominant by the idea that change originates in the environment. ... the organization has been seen as an open system that is in constant interaction with its context, transforming inputs into outputs as a means of creating the conditions necessary for survival."* (Morgan, 1997, p. 253)

This traditional view has recently been challenged by Humberto Maturana and Francisco Varela. Morgan writes that they argue that *"all living systems are organizationally closed, autonomous systems of interaction that make reference only to themselves."* (Morgan, 1997, p. 253) This view is interesting but it is very problematic because those ways of seeing the world that emerge from it are very different from traditional western management literature. According to Morgan (1997, p. 253) *"the idea that a living system is open to an environment, in their view, the product of an attempt to make sense such systems from the standpoint of an external observer."* Morgan (1997, p. 253)

The theory is based on the idea that all living systems are characterized by three principal features, namely autonomy, circularity, and self-reference. These concepts are further explained by Morgan (1997, p.253). These ideas allow new perspectives to emerge that allow us to see organizations from fresh perspectives. However, new perspectives do not arise without cost. The increase in complexity that emerges from this line of thinking seems to be very intense. In addition, ways of thinking, concepts and ideas do not lend themselves particularly well to traditional western managerial literature. Especially, the concept that organizations have borders and that we can distinguish between system and its' environment are very fundamental to western society and managerial thinking.

In non-linear systems, small changes in input can lead into large changes in output. (Morgan, 1997, p. 265) Engineering disciplines, like control systems engineering (Lewis & Yang, 1997) have developed highly advanced methodologies that allow one to study systems. Business dynamics borrows ideas from control theory/cybernetics and studies complex business systems with similar concepts that engineers use to design complex control systems for industrial plants, cars etc.

Engineering systems can contain feedback loops and other dependencies. Assuming that relationships are linear or that they can be approximated with linear functions (quasi linear, piecewise linear), one can easily develop mathematical presentations of complex systems. Linear relationships mean that the relationships between parts of the system can be described or at least approximated with linear differential equations. These functions can be piecewise linear or linear only at the region of interest. If these conditions are satisfied, relationships of even complex systems can be modeled relatively easily. These ideas are put into business use in business dynamics literature. (See Sterman, 2000)

3.6 Intensity of Information Technology Use

Inside company different inputs are utilized to produce output. In market system of organization, inputs are often measured in money. This also applies to outputs. The selection of technology that is utilized is a function of relative price levels and how many units of input are necessary to produce an output. Often similar output can be produced with different input-output combinations. Buyers in markets then select suitable input-output combinations by buying their output from market. This is a highly abstracted view but it nonetheless gives valuable information that when a price of input decreases, companies are likely to use more of it (demand curve). During last decade, price of computing (hardware, software, connectivity) have decreased in absolute terms (New Economy Index, www.neweconomyindex.org/section1_page12.html). However, similar cost reductions seem not to apply with security and integration of information systems, which may affect the use of interorganizational information systems more than the actual cost of hardware that is today relative small part of total cost of information systems. However, computing costs can be compared with other price trends like energy costs. Recently, computing has become increasingly lower cost in relative terms with energy. This naturally has led companies to use ever increasing amount of computing power. The general trend of price reduction of computing and the fact that society today uses more computing than ten years ago mean that, it is likely, that ceteris paribus the use of computing in any relationship is higher than it was ten years ago.

4 Framework

This chapter presents both context of study and then presents the framework. Context of the study chapter explains the broad intellectual basis of the study. Framework of the study explains relationship between concepts more deeply.

4.1 Context of Study

In this study trust is seen as a process that has different phases that begin from calculative trust and end into emotional bonding trust. Companies have different kind of relationships between different companies. One company may have at any time many relations to many companies that are all in different phase. The evolution of trust is not predetermined; it completely depends on context and strategic needs. Trust is seen mainly as a trust between companies; this means that trust is seen in social context. The emotional aspect of trust is part of any relationship, even business relationship. However, trust in this study has to be seen in business context where emotional side usually is less important than other considerations.

The study draws insights from industrial network perspective. Industrial network perspective discusses networks of companies. These networks are self forming and autonomous. True networks don't have any rigid centers. In networks, trust plays a pivotal role in allowing companies to function as a large organism in coordinated fashion without rigid ownership structures. It is in these networked organisms, where we can find innovative uses of information technology.

Trust is information and if you have massive amounts of information, it has to be managed or you are going to drown into it. This is why knowledge management is also utilized as a source of inspiration and wisdom. Especially, Nonaka's extensive work is acknowledged. In network approach, researchers sometimes forget why companies exist. They do not exist because they are part of network. They exist because they are used as vehicle to create shareholder value and this again means that they maximize their own profit rather than the collective profit of the network. Transaction cost economics allows us to understand different kind of relationships and why

companies enter into relationships in the first place. And why they don't simple transact in the marketplace or directly integrate vertically.

From knowledge management we learn that we can learn collectively. This is actually something that networks do. Something very similar is also found in learning organization tradition. Moreover, learning is a cyclic process. It is important that shared knowledge domain is created between companies. Knowledge domain exists partially in organization processes and structures. Computer networks can be part of knowledge domain. However, learning processes are mainly organizational processes and they mainly take place outside of information systems. More specifically, knowledge domain (cyber ba) can exist around companies' interfaces and it can exist partially inside shared information systems. Cyber ba also exists inside companys' internal information systems and these domains are partially interlapping. Moreover, this knowledge domain is supported by knowledge creation cycle.

The contextual setting of this study is presented in figure 4. It establishes the main considerations and surroundings. The focus is on trust and shared IT (interorganizational information system). Trust can be further divided and these divisions are explained in chapter 2.1. The whole phenomenon under study lives between companies in their interorganizational processes (in supply chain). Trust also has time dimension. This is depicted as different phases of trust and it is discussed in chapter 2.2. The knowledge management explains how companies can collectively learn from their experiences. This acts as a memory of the relationships.

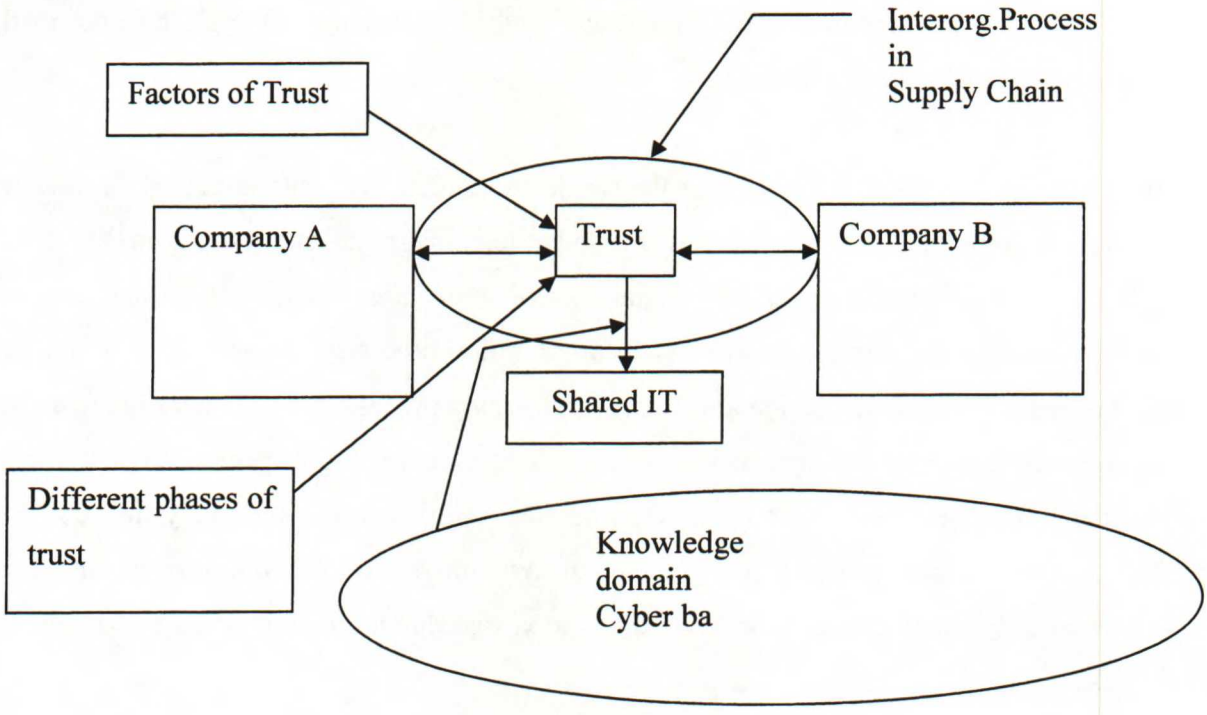

Figure 4. Relations between concepts

4.2 Framework of the Study

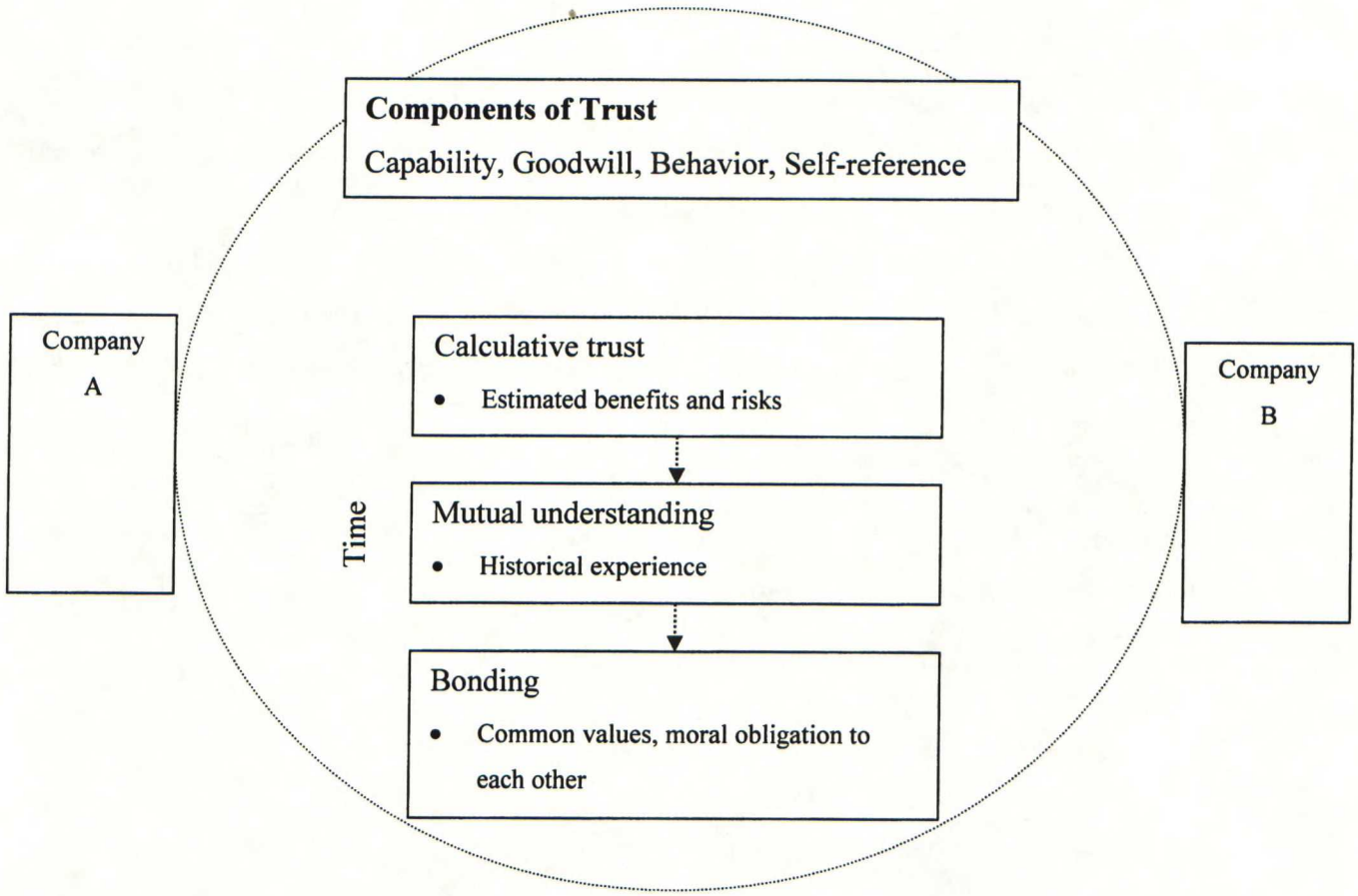

Figure 5. Framework

Figure 5 presents the study's framework. The framework contains two companies, namely Company A and B. These companies are again part of the same supply chain which is part of wider network of companies (not in figure 5). Shared information system (interorganizational information system) is implemented between these two companies A and B. Moreover, connections to other information systems in other companies are not described in the figure 5. Trust exists between these two companies (Trust is depicted as dotted circle). It has four dimensions: Capability, Goodwill, Behavior and Self-reference. In addition to these four dimensions, it also has time dimension. It evolves over time from calculative trust into bonding. Trust evolution (in time) in figure 5 is depicted as arrows that lead from calculative trust into mutual understanding and finally into bonding. However, the evolution of trust is not certain and it may also develop into reverse

direction and it is also possible that the relationship terminates itself. In short, the trust is created and recreated in symbolic exchange process between companies A and B. It has time dimension that allows it to evolve but the direction of evolution may be into deeper form of trust or in less trustful relationship. Moreover, trust also has dimensions that connect it to wider company networks (and stakeholder networks) but these are not part of framework.

This diagram can be further simplified into figure 6. From figure 6 we can see that trust exists between two companies in relationship. The trust cyclically circulates around itself. The trust is autopoietic, so it recreates itself. This happens in the presence of shared information systems. Shared information systems are not directly part of the circular loop that defines trust creation. Rather, information systems catalyze increased trust creation. This again should lead into intensive use of information technology, especially shared information systems. In figure 6, the system is closed. It is logical to assume from the assumption that the system is closed means that shared information system and even the companies in question are inside the assumed trust concept. However, due to the practical difficulties of using autopoietic concepts, researcher uses this simplification only as an aid. Figure 6 may present reality better that figure 5 but figure 5 lends itself better for operationalization.

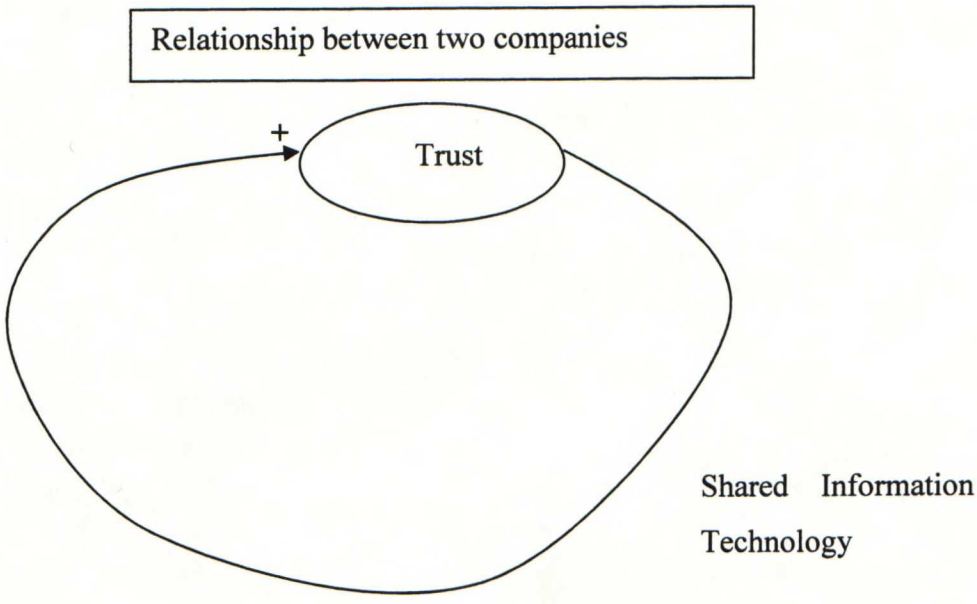

Figure 6. Autopoietic trust creation process

5 Methodology

5.1 Selection of Research Method

The purpose of this chapter is to present and justify the research approach and describe the empirical data of the study as well as the methods of analyzing them.

The main purpose of this study was to examine how *trust affects utilization of shared information technology in Supply Chain.*

In the design of research study, skills and resources of researcher should be taken in account (Remenyi et al., 1998, p. 46). In this case, researcher has no prior experience and other resources are greatly constrained. Thus, a low skill, low cost approach is appropriate.

1. According to Yin (1994, p.4) there are three conditions, which determine the selection of a research strategy: The type of research question.
2. The control a researcher has over actual behavioral events, and
3. The degree of focus on contemporary as opposed to historical events.

Strategy	Form of research question	Requires control over behavioral events?	Focuses on contemporary events?
Experiment	How, why	Yes	Yes
Survey	Who, what, where, how many, how much	No	Yes
Archival analysis	How, why	No	Yes/No
History	How, why	No	No
Case study	How, why	No	Yes

Table 1. Relevant Situation for different Research Strategies

Source: Yin, 1994, p.6

The main research question is '*How trust affects utilization of shared information technology in Supply Chain?*' It has been argued that the first and the most important condition for differentiating among the various research strategies is to identify the type of research question. (Yin, 1994, p.7) This is clearly, a 'how' question. This would imply that case study approach would be appropriate research method. 'How' question is more explanatory and case research methodology is well suited for it. (Yin, 1994, p.4-6) Research question also deals with contemporary issues. This means that history is not appropriate research approach. Archival analysis is also out of question, because researcher does not have access to suitable archive. Survey as a research methodology would be appropriate, but it is not selected as research methodology because researcher wants to be able to gain deeper access to individual case company in order to gain deeper insight. Researcher also considers that it would be difficult to produce meaningful surveys because too little is actually known from topic. Survey respondents might also find it difficult to answer into questions that are not normally associated with their professional life. Trust is a concept that has traditionally received relatively modest attention in both strategic management and organizational practice.

All research ultimately refers back, directly or indirectly to observations, experiences, or measurements. There are several ways how observations can be made.

- Passive observation
- Uncontrolled intervention
- Observation of Deliberate Intervention

(Remenyi et al., 1998, p. 73)

According to Remenyi et al. (1998, p.73) passive observation is the method most frequently used when the researcher is unable to conduct an experiment and has to rely on evidence that already exists. Evidence is collected in the form of interviews, written reports, questionnaires, artifacts, and so on. (Remenyi et al., 1998, p.75) The researcher collected evidence by interviewing company representatives and also by collecting written material. In addition, researcher had very little control over actual behavior. In case method, researcher does not have to be able to control actual behavior. Furthermore, the focus is on contemporary issues. Moreover, according to the conditions set by Yin, case method was appropriate (Yin, 1994, p.4).

Research can also be classified in terms of their purpose as well as research strategy. Often research purpose is classified to exploratory, descriptive, and explanatory. (Saunders et al., 1997, p. 78) The relationship between trust and information technology has received very little attention in prior literature. The goal of this study is to explore how these concepts are related. However, the intention of this study is not to produce any causality between trust and use of interorganizational information systems.

5.2 Data collection

Yin (1994, p.78) discusses six sources of evidence: documentation, archival records, interviews, direct observation, participant-observation, physical artifacts. In the empirical part multiple sources of data was utilized. This was done in order to be able to increase construct validity of research. (Yin, 1994, p.78) A major strength of case study is the use of multiple sources of evidence. (Yin, 1994, p.91) Multiple sources of evidence allow researcher to develop converging lines of inquiry and in addition to this, it increases accuracy of findings and conclusions. (Yin, 1994, p.92)

Source of Evidence	Strengths	Weaknesses	In this study
Documentation	Stable can be reviewed repeatedly Unobtrusive – not created as a result of the case study Exact – contains exact names, references, and details of an event Broad coverage – long span of time, many events, and many settings	Retrievability - can be low Biased selectivity, if collection is incomplete Reporting bias – reflects (unknown) bias of author Access may be deliberately blocked	Case company's web site. Additional material searched by Google from Internet.
Archival Records	Same as above for documentation Precise and quantitative	Same as above for documentation Accessibility due to privacy reasons	Case company's web site. Third party archives concerning the case company.
Interviews	Targeted – focuses directly on case study topic Insightful – provides perceived causal inferences	Bias due to poorly constructed questions Response bias Inaccuracies due to poor recall Reflexivity – interviewee gives what interviewer wants to hear	Personal visits to selected case companies by author. One hour interview. Both part of the relationship studied.
Direct Observations	Reality – covers events in real time Contextual - covers context of event	Time-consuming Selectivity – unless broad coverage Reflexivity – event may proceed differently because it is being observed Cost – hours needed by human observers	Informal observations during interviews and visits to case company's premises.
Participant-Observation	Same as above for direct observations Insightful into interpersonal behavior and motives	Same as above for direct observations Bias due to investigator's manipulation of events	
Physical Artifacts	Insightful into cultural features Insightful into technical operations	Selectivity Availability	Case company's web site, buildings, physical layouts of office, office furniture, placement of computers, other cultural artifacts

Table 1. Sources of Evidence

Source: Adapted from Yin, 1994, p.80

All forms of evidence were used. Case company's web site is a form of documentation and web sites were researched. The archival material in these web sites was analyzed as well.

5.2.1 Interviews

Due to difficulties to gain deep access to selected company, the ability to access people with relevant information played an important role. Open-ended interviews were utilized in the study. This allowed interviewer to ask questions concerning facts and respondents opinions as well. (Yin, 1994, p.84) Researcher interviewed one respondent from both companies that were responsible for

the maintenance and development of relationship between companies. Both interviews happened in Finnish language.

Researchers approach to interviewing was a form of active interviewing technique, where interviewer and respondent construct reality with the aid of interpretative resources available. (Holstein and Gubrium, 1995, p. 15) In active interviewing, interviewer and respondent collaboratively construct the meaning of interview narratives. (Holstein and Gubrium, 1995, p. 59) Researcher gave respondents, in the beginning of interview questions, which were designated to lead interview from topic to topic. He had also sent them by e-mail two days earlier, so respondents could familiarize themselves with these. The questions also functioned as an aid for researcher to remember to discuss with respondent all relevant issues. Researcher also informed, in the beginning of interview that questions he gave to them were there to be interpreted as reminders of important issues and respondents could freely elaborate.

Conversational interviews are usually recorded through audiotape. (Lee, 1999, p.86) Recordings are rarely analyzed directly; usually they are transcribed. (Lee, 1999, p.87, 88) This was also the case with this study. In interview, researcher utilized digital audio recorder Olympus VN-480 and Olympus Digital Wave Player as a audio playback software. These allowed digital recording and further analyze of recordings with the aid of computer. Researcher also made notes into question paper during interview. These notes were further transformed into digital document by scanning them into digital form. This allowed researcher to easily compare notes, digital recordings and transcript of recordings. Researcher also utilized dual screen configuration that allowed him to keep all relevant documents at his eye sight all the time. This allowed researcher to easily process documents (text and audio). These actions essentially transformed linear documents into an essentially non-linear form, which allowed researcher easily access documents and to compare them with each other.

In order to increase reliability in transcription, Lee (1999, p.88) recommends that two different persons transcribe the same audio file and then it is compared how these text files compare. This method was considered too expensive, and it was rejected. The method adopted for reliability testing was very simple. Researcher first transcribed the text, and then listened it carefully while reading it at the same time. The match between text and audio file was almost 100% (from correct words). This high number was achieved, because in the transcription process, advanced digital audio technologies were utilized. After having produced transcripts of interviews, researcher sent

document containing both questions and answers at summary level to respondents. In addition, researcher asked for their comments and if they could add some new insights. This allowed researcher to check that information was correct and allowed him to deepen his understanding of case companies' business context.

In order to gather relevant information from case companies, various databases were researched before and after actual interviews. Search engine Google (www.google.fi) was utilized extensively to find information from the Internet. This information allowed researcher to make better research questions and it increased the level of knowledge perceived by respondents.

Documents were collected from case companies' web sites. Collected documents were printed on paper or saved locally on disk for further analysis. Locally saved documents were archived using Microsoft Internet Explorer. This allowed researcher to easily store, classify and retrieve web documents. This software made it easy to build the case study data base that is necessary in order to increase study's reliability (Yin, 1994, p.33). Documents were further made searchable by Google Desktop. This allowed further delinearization of documents.

5.2.2 Observation

Personal visits to the case companies allowed researcher to observe interviewees in their natural environment. Visits allowed researcher to see where different parts of firm were located in firm's buildings and this increased researchers understanding of firm's operations. This also allowed researcher to observe company's culture. (Yin, 1994, p.86-87) Researcher was toured through both companies' factory. This allowed researcher to gain additional information concerning companies' ways of operating.

5.2.3 Selection of Case Company

Major decision in designing case study is whether it is single or multiple case designs. Single case design is appropriate when it is critical case and it allows researcher to test well formulated theory.

(Yin, 1994, p.38) Second rationale for researcher to use single case design is when the case presents extreme or unique case. (Yin, 1994, p.39) Third case is when the case is revelatory case. This means that the case allows researcher to observe or investigate phenomenon that was previously inaccessible to science. (Yin, 1994, p.40) In contrast to single case study design, multiple case study design offers several advantages. The evidence from multiple case studies is usually considered to be more credible. This means that the overall study can be considered to be more robust. However, the cost of conducting multiple case studies is considerably higher than with single case study designs. (Yin, 1994, p.44-45) The higher cost has to be balanced with overall goals and resources of research objectives. Researcher selected single case design as case design. The selection was heavily influenced by cost and resource considerations.

The same case study may contain more than one unit of analysis. This happens when in case study attention is given to subunit or subunits. (Yin, 1994, p.41-42) This approach is called embedded case study design. The opposite approach is called holistic case study design. In holistic case study, study is not divided into subunits. The approach is advantageous when underlying theory is also holistic. (Yin, 1994, p.41-42) This study uses embedded case study design. The reason is because underlying theory is not holistic. It is possible to divide case into various subsystems that can be studied individually. The case study consisted of one relationship between two companies. Both members of the relationship were studied separately. The alternative of using holistic case study would not fit the case because under investigation is relationship between two companies and even though relationship can be considered as holistic, one can separate two logical subunits, namely Rocla and Orfer.

When selecting appropriate case companies, following factors were included in decision which case companies to include in the study. Considered factors were in order of decreasing importance: the first (1) criterion was closeness to Helsinki in order to minimize travel costs. Closeness to Helsinki does not necessarily bias sample considerably, because Helsinki area is the center of business in Finland. Second criterion (2) was that case companies were using computer systems to facilitate inter-company communication. Third criterion (3) was that both parties of the relationship could be studied. Both criterion 2 and 3 were necessary in order for this study to make sense. These were absolute constraints that limited the pool of candidate companies.

Tests	Case study tactic	Phase of Research in which tactic occurs
Construct validity	Use multiple sources of evidence	Data analysis
	Establish chain of evidence	Data collection
	Have key informants review draft case study report	Composition
Internal validity	Do pattern-matching	Data analysis
	Do explanation building	Data analysis
	Do time series analysis	Data analysis
External validity	Use replication logic in multiple-case studies	Research design
Reliability	Use case study protocol	Data collection
	Develop case study data base	Data collection

Table 2. Case Study Tactics for four Design Tests

Source: Yin, 1994, p.33

5.3 Validity and Reliability

Trust is in existing literature defined in multitude of ways and there exists no widespread acceptance in exactly what it is. In trust research, certain level of ambiguity exists in constructs. Ambiguity in trust is unavoidable and it cannot be removed without cannibalizing the whole concept as meaningless. Trust defies simple abstractions; it is a complex being without simplistic skeletons living in our complex universe. Unfortunately, this means that validity is low almost by definition. With simplistic world view, one can achieve good validity but little "real" understanding.

In this chapter validity is examined against criteria developed by Yin (1994). Four tests have been commonly used to establish the quality of empirical social research. They are construct validity, internal validity, external validity and reliability and these tests are summarized in table 2. (Yin, 1994, p.32-33)

5.3.1 Construct Validity

In the data collection, multiple sources of evidence provide multiple measurement of the same phenomenon. (Yin, 1994, p. 92) The use of multiple sources increases substantially research costs. Another burden is that the researcher has to master multiple research techniques. (Yin, 1994, p.93) In the study multiple sources of evidence were utilized including interviews, various forms of documents, and observation. This allowed researcher to triangulate between sources and therefore to increase construct validity.

5.3.2 Internal Validity

According to Yin (1994, p.33) internal validity concerns how to establish a causal relationship, whereby certain conditions are shown to lead to other conditions, as distinguished from spurious relationships. Internal validity is only relevant for explanatory or causal studies. (Yin, 1994, p.33) Since this study intends not to produce any causal link between trust and use of interorganizational information systems, this criterion is not important. However, if study would be extended to include direct statement of causality, this criterion would become more important. Trust in this study is seen as being autopoietic. This seems to imply that trust is so connected with its environment that the separation that is necessary to imply causality does not exist.

5.3.3 External Validity

External validity concerns with how generalizable study's findings are. This has been major problem in case studies. External validity is increased by using replication logic instead of sampling. (Yin, 1994, p.36) The selection of case company was based on convenience sample. This means that external validity is relatively low.

5.3.4 Reliability

Reliability can be increased by using two separate documents: the data (evidentiary) base and the report of the investigator. The database allows other investigators to review data independently. Database consists of notes, documents, tabular materials, and narratives. The form of notes can be anything from handwritten notes to recorded interviews. Notes should be classified so that they can be easily retrieved. It is sufficient that notes are organized, categorized, complete, and available for later access. There is no need to edit them in order to make them more presentable. Researcher should develop similar system for facilitating storage and retrieval of documents, tabular materials and narratives. (Yin, 1994, p. 94-97) Researcher implemented data base in electronic form. All data was put into computer directory. This was made searchable by allowing Google Desktop to search it. This allowed researcher to easily search documents via keywords. Documents that were initially in paper form were digitized and then stored into data base (directory). Relevant documents from Internet were also archived into data base. This made it possible to find relevant documents easily and it allowed automatic searching.

Another principle to increase reliability is to maintain the chain of evidence. This means that external observer should be able to follow the derivation of any evidence from initial research questions to ultimate case study conclusions. This is achieved by that the report contains sufficient amount of citations to the relevant part of database. In addition, the database should contain the actual evidence and the circumstances where evidence was collected. It is also important that the database is done in the way described in case study protocol. There should be link between Case study protocol and initial study question. (Yin, 1994, p.98-99) All case documents were put into electronic folders and they were indexed with Google Desktop. This allowed searches on the basis of key words. During research, researcher lost two hard drives that contained primary copies of research database. Both hard drives failed because of disk failure but thanks to extensive back upping, no data was lost. One possible reason for hard disk failure was the need to heavily access hard drives and this led to excessive wear and tear. The final research database approached 200 Mbytes in size. The database was constantly accessed during research and this led to extreme loads to system.

Full linkages were created between electronic audio file of interviews, notes of interviews in electronic format (scanned) and transcript of interview word by word. Transcript document

contained time based links to audio files so the exact comparison of audio file and transcript was possible. Transcript text also included comments on intonation and observational feelings. These comments were marked between parentheses. This allowed research also to assess silent communication.

5.3.5 Case Study Protocol

Case study protocol is used to increase reliability of case study. It is especially important for multiple case studies. It contains the instrument and general procedures and rules that should be followed in conducting the case study. (Yin, 1994, p.63) Due to the fact that the size of research is small and conducted only by one person, there is no reason to produce as complete case study protocol as recommended by Yin (1994). Extensive protocol would not serve any real coordination purpose. Full case study protocol is replaced by this chapter and appendixes A to C. Appendix A and B present research questions that were given to respondents (interviews were conducted in Finnish). Appendix C presents part of letter that was used to introduce respondents into research.

6 Case Companies

Two case companies were selected on the basis of access and that they had shared information systems in use. Business relationship between companies is approximately 10 years. Their relationship has gradually deepened. (Interviews: Seppänen, 2005 & Stuck, 2005) Both companies are industrial companies.

Researcher interviewed one person from both companies. Interview took approximately one hour. Both interviews were conducted in Finnish and after interview they were transcript. Interview was carefully designed in order to facilitate interaction and allow respondent to respond in free format in order to elicit truthful and meaningful results. These results were then triangulated with each other and with information that was available from public sources in order to arrive into meaningful and truthful results.

Next both companies are going to be discussed and research results are going to be reported.

	Rocla			Orfer		
	2003	2004	2005	2003	2004	2005
Net sales (M€)	80.9	91.7	96.6			10
Operating profit	-1.5	2.9	4.2			
Number of Personnel (average)	449	409	439			100

Table 3. Key Figures of Case Companies

6.1 Rocla

6.1.1 Background

Rocla operates in two businesses: trucks and automated trucks. Company's products and services are used to improve logistics in commerce and in industrial settings. (Rocla, http://www.rocla.com/hex.asp?Section=179 , 2005) Their 2004 net sales were 92 M€ and growth from 2003 was 13%. Their 2004 operating profit was 4.9M€ and they employed on average 342 persons. Most of their 2004 sales took place in Europe (86%). 11% took place in North and South America. (Rocla 2004 Annual Report) 2004 Rocla produced in Järvenpäää 5 700 trucks. In near future, they are going to increase their annual production capacity into 10 000 trucks per annum. (Rocla, www.rocla.com/page.asp?Section=403&Item=2577) Rocla is listed Helsinki Stock Exchange (HEX, www.hex.com). Its main owners are Etra-Invest Oy Ab (26.9% of shares) and Mitsubishi-Caterpillar (30.8% of shares). (Rocla Investor pages, www.rocla.com/hex.asp?Section=383).

6.1.2 Main Products and Services

Rocla's main products are trucks (Rocla, www.rocla.com/page.asp?Section=27, 2005) and automated trucks (Rocla, www.rocla.com/page.asp?Section=656, 2005). Figure 7 shows Rocla truck. This truck is operated by man.

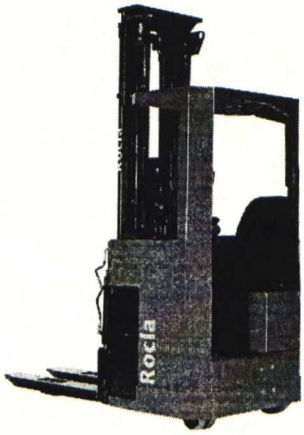

Figure 7. Rocla truck

According to Rocla: *"An automated guided vehicle (AGV) is an automated electric truck that performs driverless material handling operations between load handling positions."* (Rocla, www.rocla.com/page.asp?Section=656, 2005)

AGV systems are robots that transfer loads. They are computer controlled and can be configured to different customer requirements in different industries. These robots help companies to reduce their payroll costs and help them to improve efficiency of logistics. AGV robot is presented in figure 8.

Figure 8. Rocla Robotruck (Automated Guided Vehicle, AGV)

6.2 Orfer

6.2.1 Background

Orfer was founded in 1970. During the last ten years, it has achieved market leadership position in Finland in industrial food packaging systems. Currently Orfer employes 80 persons. (Orfer , www.orfer.fi/pdf/35vuotistiedote.pdf, 2005) Ten years ago, Orfer started to import Japanese Kawasaki industrial robots. During the last year they have added Toshiba's robot in their selection. (Orfer, www.orfer.fi/pdf/10vuotta_robotiikkaa.pdf, 2005) Orfer also offers service contracts to systems that they have build. (Orfer, www.orfer.fi/huolto.html, 2005)

In addition to robotic systems, Orfer also offers assembly services to its' customers. They offer services in steel molding, assembling components and logistics services linked to manufacturing components. (Orfer, www.orfer.fi/standardi.html, 2005)

6.2.2 Main Products and Services

"Orfer develops, engineers and manufactures versatile, robotised material handling systems. Our special area is packaging and palletizing systems." (Orfer, www.orfer.fi/englanti/index.html)

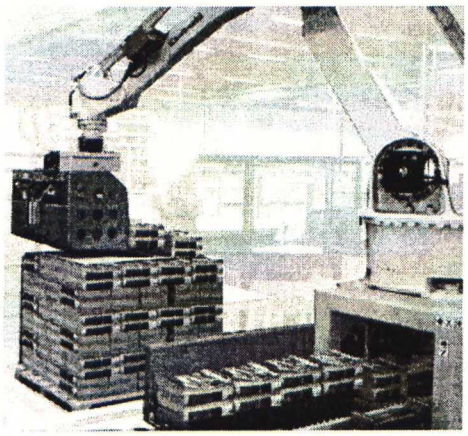

Figure 9. Palletizing Robot
(Orfer, www.orfer.fi/englanti/palletizing.html)

These robots can handle different kinds of packing needs. They can be controlled by a PC and they enable automatic production. (Orfer, www.orfer.fi/englanti/packing_palletizing.html) These robots allow companies that come from high labor costs to compete effectively against companies that produce in very low labor cost countries (like China). Figure 9 presents an example of palletizing robot that is commonly utilized in industrial production.

6.3 Relative Positions in Value Chain

Rocla is located in downstream position compared to Orfer. Rocla buys components from Orfer. Both companies have had some level of interest into deepening their interest by gradually increasing level of co-operation into more value added components/sub assembled components and even to in-house designed components. However, companies may have slightly different kind of attitudes toward the level of commitment that might be desirable. (Interviews: Seppänen, 2005 & Stuck, 2005) Rocla is approximately 10 times greater than Orfer in terms of revenues. They also

employ 5 times more personnel. This means that in terms of size, the level of power that they have in their relationship is asymmetric. This became also evident in discussion and both acknowledged asymmetry between companies. There was also agreement on its' direction. (Interviews: Seppänen, 2005 & Stuck, 2005)

The manufacturing service that Orfer offers to Rocla is not unique in any particular way. Rocla can receive similar manufacturing services from other sources. However, Orfer has been able to successfully deliver their deliverables in the past. Rocla acknowledges this and seems to be willing to develop relationship further. Generally speaking Rocla seems to be reasonable satisfied with Orfer's performance. However, during interview, Rocla emphasized the fact that costs remain an important consideration. He explained that due to heavy competition in their industry, it is imperative to pay very close attention to manufacturing costs – and component/sub assembly costs are also very important part of their overall cost structure. This means that manufacturing costs are very important and cannot be overlooked. (Interviews: Seppänen, 2005 & Stuck, 2005)

Level of communication that is necessary to support Orfer's vision of actually being able to supply components that are designed into customers' specifications is far greater than simple production of components/subassemblies that are designed by either Rocla or some third party. In order to be able to secure their supply position and increase their value added services (design) instead of basic manufacturing services, they have to be capable of portraying themselves as capable and trustworthy supplier.

6.4 Use of Information Technology

Both Rocla and Orfer are long time users of information technology. Both have been using information technology since 1980s. Intensity of use has gradually increased and both companies' representatives consider that they have both personally and as a company good experience with information technology. They also consider that good experiences have gradually allowed them to deepen their use of information technology. (Interviews: Seppänen, 2005 & Stuck, 2005) These views are compatible with the idea that trust develops gradually. Also involvement and positive experiences seem to confirm that the decision makers prior belief that information systems can

benefit business operations. Both companies are also operating in business environment where technology is utilized heavily both by their customers, suppliers, wider community, and society as a whole (Finland). Both companies are employing people with technical skills and other advanced skills. These factors mean that both companies receive signals from their environment (links to environment, customers, suppliers, engineering profession, etc). These beliefs are then continually reinforced and then they create mutually enforcing spiral where positive signals are reflected.

During interviews both respondents were enquired concerning their beliefs toward information technology and both answered that their views were positive towards it. Both companies had been using information technology since 1980s. Both companies had started their career in information technology from small scale individual computing systems, and gradually extending their use of information technology into more advanced networked information systems with multitude of applications. This expansion of use had been gradual and happened over relatively long period of time. As a result, both companies had acquired considerable prior experience with information systems before actually implementing web based interorganizational systems. Web based electronic commerce system was implemented between Rocla and Orfer 3 years ago. The system was supplied by WM-data and the system is a "standard" service Työkalupakki. (Työkalupakki, www.tyokalupakki.fi) Työkalupakki is an ERP like system that supports value chain activities from purchasing into sales including production and administrative functions. It also supports interorganizational communication through XML. Työkalupakki is used by Rocla as their ERP solution. (Interviews: Seppänen, 2005 & Stuck, 2005; Työkalupakki, www.tyokalupakki.fi)

The rationale for Rocla for implanting interorganizational information system was the need to deliver specific information to suppliers (orders, inventory etc.) and vice versa. Most commerce between Rocla and Orfer go through web, only orders that are not repeating are done manually (phone, e-mail, face-to-face). Specifications and other documents that are necessary for commerce are also mainly transferred electronically by web based system. Transferred documentation is in various different file formats: Solid Works (www.solidworks.com), various other CAD formats, in raw picture format and as Word documents. (Interviews: Seppänen, 2005 & Stuck, 2005)

The fact that computing, especially computer software is expensive came up during interview. Both companies cited cost as one drawback of information systems. Cost of individual system component is rapidly decreasing (Interviews: Seppänen, 2005 & Stuck, 2005). However, overall system costs do not experience similar reduction in price due to increasing complexity; especially

cost of interorganizational systems is unlikely to experience similar cost reductions as is feasible with simple hardware/software system prices. High cost of information systems integration creates costs that create incentives for companies to strive for long term relationship with limited number of partners. This means that companies have financial incentives for trying to create trust into their relationships because of relationship specific capital that is employed in the form of information systems.

During last ten years, the use of information technology has increased in society. This is due to radical reduction in the price of computing and increases in the utility of computing. This societal phenomenon alone causes both Rocla and Orfer to use more computing in their relationship. This effect was cited by both companies in that they have increased their use of computing resources. This means that with the information available we cannot separate from general trend of increasing use of computing the exact effect of trust in relationship.

Both Rocla and Orfer operate in high technology sector of metal industry. Robotics systems are heavy users of computing resources (Craig, 2005, p.3). This means that both companies exist in heavily computerized environments where they use computers in all their operations and their products themselves use computers and software heavily. This obviously gradually helps them to accept computers as partners in their everyday working environment. Automation technology, as a form of control technology is a very heavy user of digital control, which by definition, is always implemented by a computer system (Franklin, Gene F. et al, 1998, p.1, 8).

6.5 Relationship

Relationship between Rocla and Orfer is approximately ten years old. Their relationship started from small scale component procurement and has over time, when Orfer's capabilities have increased, evolved into a level where Rocla and Orfer have implemented web based electronic commerce between themselves. Rocla does electronic commerce between 15 of its business partners. According to Rocla, relationship between Rocla and Orfer is not among the most important single business relationship it has, but it is nonetheless important. (Interviews: Seppänen, 2005 & Stuck, 2005) However, based on information received during interview, Rocla regards Orfer as a source of manufacturing services. Rocla emphasizes cost in their relationship with Orfer.

Moreover, during interview it was several times emphasized by Rocla that due to heavy price competition in their industry costs are very important. (Interviews: Seppänen, 2005)

Relationship is maintained by having two meetings per annum at senior level. People from both companies also meet each other case by case basis when actual need arises. Senior level meetings are usually accompanied by 1-3 persons. During these meetings, long term plans are discussed. Meetings allow both companies to align their strategies and develop trustful relationships. In addition, distance between companies' headquarters is approximately 50 km. This means that travel time is not an issue. (Interviews: Seppänen, 2005)

Based on evidence gathered, it seems that their relationship have started from calculative trust phase (Child, 2001) as predicted by literature review. During the last ten years, they have gradually increased their commitment into relationship. This pattern follows also Child's (2001) writings. Their use of information technology has also followed similar pattern. They have gradually increased their use of information technology in their business relationship. During last three years, the level of electronic communication has exploded due to establishment of permanent electronic communication medium. According to Rocla, this has enabled relationship to deepen. Furthermore, Rocla also comments that the relationship probably would not have evolved in as positive fashion without it (web based electronic commerce links) (Interview: Seppänen, 2005). This view is reasonable in the light of transaction cost economic in a sense that permanent electronic commerce links decreases transaction costs. At the same time it creates relationship specific capital asset which facilitates the ongoing expansion of relationship, because parties to relationship contract have incentives to deepen and develop their relationship because without it they would not be capable of recouping investments from relationship specific capital.

6.6 Components of Trust

Trust in this study was composed of four components, namely capability, goodwill, behavior, and self-reference (Blomqvist, 2002). These factors were important part of case study interview questions. Components are here discussed all separately.

6.6.1 Capability

Capability in industrial company is about manufacturing, logistics and service capabilities. Also meta capability to co-operate is important. Capability to execute business decision and maintain promises is also a function of capability.

Rocla continually assess its' suppliers capabilities to serve their business needs. Supplier is accessed in supply auditioning process. In this, Rocla checks out that supplier are capable of producing product that they need in terms of technology. This means in practice that they check that prospective supplier does have necessary machine, spaces and working atmosphere that is necessary. (Interview: Seppänen, 2005).

According to Seppänen (2005), web based inter-organizational system has deepened co-operation. Seppänen also comments that:

"It has deepened co-operation. It has given continuity and security. We have done it as a pilot with Orfer. WM Data, Orfer, and we all three. We have done it as triparty co-operation project." (Interview: Seppänen, 2005).

Interorganizational information system has also improved Rocla's capability to be able to know what is happening in relationship. Orfer receives information concerning Rocla's orders and they can pick up what they want to supply and then they have to confirm their supply promises. Seppänen says that:

"Yes, it helps when they [Orfer] receive information all the time and they have to pick up orders and confirm them, we follow all the time the system and our logisticians follow from the system that they tick the right place." (Interview: Seppänen, 2005).

According to Rocla, co-operation has deepened with all companies that they have web connectivity. Co-operation has gone further and it has also improved. Rocla has also seen improvement in suppliers' capability to deliver on promise. (Interview: Seppänen, 2005).

6.6.2 Goodwill

Goodwill compasses issues like moral responsibility and ethical approach. Also generally positive intentions are also part of it. In a relationship between Rocla and Orfer relatively high level of goodwill seems to exist. Their business relationship is already ten years old and it has been improving and both parties seem to be willing to continue to expand it. During interviews, both parties said that relationship has been improving and there are not any major issues. (Interview: Seppänen, 2005) This is also evidenced by the fact that they implemented web based electronic commerce between themselves. The establishment of electronic commerce is an investment into relationship specific asset and this asset would become worthless if they discontinued their relationship.

6.6.3 Behavior

Senior management of both companies meet annually and also specialist from respective fields meet each other when it is necessary to solve day-to-day issues. Communication happens almost daily by e-mail or phone. Follow-through of promises has improved because both companies can see from web orders and that they have been satisfied. This creates trust because data can be instantly verified.

During development of system, the level of communication increased considerably. To an extent, those communication links that were created during development phase are still in place. Moreover, these links have contributed for relationship development between Rocla and Orfer.

The system is created in such a way that if there is a deviation from plan, supplier (Orfer) can easily send messages by e-mail. Rocla comments on that,
"This [web based system] is build in such a way that if there is deviation, supplier can easily send e-mail to us. You can freely write into it what you want. This kind of personal contact decreases when you have a system. There machines speak with each other. We have here done here so that at different organizational level employees visit there and they visit us and then they have learned to work and our culture that way." (Interview: Seppänen, 2005).

Both companies have implemented organizational adaptations that increase communication. Due to the fact that routine communication decreases because simple orders are done automatically by machine. There is a need to increase communication by implementing organizational practices that create communication and cultural interaction among employees. These actions allow employees to learn collectively in networked context. Both personal and organizational communication links create possibilities for shared learning experiences to emerge and this facilitates the creation of shared meaning of what is important and what is not. From chaos emerges order.

6.6.4 Self-reference

The self-reference is important because it allows company to self reflect and evolve. In essence, self reference creates feedback loop that allows company to actually control and develop. This capability is very important for trust creation because it implements feed back loop between signals in relationship and between companies.

Issues relevant to self-reference were discussed during both interviews. Self-reference to a certain degree deals with issues that have been traditionally discussed in strategic management literature and practice. Due to these reasons, both companies seemed to have had solid understanding of identity and mature perception of capabilities. According to Rocla,

"This Orfer is that kind of that they have reporting system. They follow all the time their supply performance. That is a positive exception among many suppliers. Mainly, suppliers do not know their own capabilities. For example, how much capacity they do have." (Interview: Seppänen, 2005).

To a great extent, it seems that self-reference is at both companies at a level where trust creation is feasible and likely. Self-reference is likely to be a function where there is a certain threshold level and after that has been exceeded; increases in it have limited utility until it again increases enough to cross some level where increases in it become again meaningful.

7 Discussion

The existence and relevancy of trust can be experienced by imaging a world without trust. What kind of societies would emerge if man was not equipped with capacity to create trustful relationships? World (society) without trust would have to implement extremely harsh control structures in order to force people to co-operate and just to survive without killing each other. Trust (and God) allows societies to achieve at least some level of co-operation without extreme control. This comparison of trust and God bring us almost at transcendental level, allowing us to proceed into the world of Gods and other deities. Man has limitations, God(s, deities) do not. Similarly, trust at the same time compresses and lifts relationship at higher abstraction level. It allows us to forget about details that might hinder our understanding of reality. It allows us to map relationship into a trust space ("trust" transform function) and this again allows us to gain new insights.

Empirical part of the study consisted of two case companies and two interviews. The relationship was studied from both directions in order to fully understand its' dynamics. Case companies proved fertile ground for testing framework. Respondents from both companies were capable of answering into questions. The questions also seemed relevant to respondents and they were capable of actually elaborating from them. At general level, the framework seems to be valid and it can shed light into how companies' relationships evolve.

All four dimensions of trust proved to be meaningful to respondents. Relationship had started approximately ten years ago from small scale business and it had gradually both deepened in scope and scale. This is largely compatible with Child's (2001) view that trust between organizations evolves in phases; starting from calculative trust and expanding from that. The relationship formation between Rocla and Orfer has been gradual. It has over years deepened and they have been able to learn to know each other well enough to be able to proceed to next level of trusting. Three years ago the relationship achieved a new milestone when they implemented Internet based interorganizational system between each other. Their volume of business had grown sufficiently in order to make investment profitable at business level. Also the necessary trust had been in place in order to implement the interorganizational information system. The implementation process required high level of involvement from both parties. This proved to be a learning experience that

allowed both Rocla and Orfer to learn to co-operate at deeper level. Both parties have been satisfied with the system.

High cost of system implementation was cited as one major concern. Rocla and Orfer are still relatively small industrial companies (revenues 100M€ and 10M€) and they operate in a field that is highly competitive and where profitability is difficult to achieve due to large number of competitors. During interviews, the cost issue was raised several times. The cost of interorganizational system implementation remains relatively high because of need for skilled personnel in implementing interfaces between systems (software packages etc) and other changes into "standard" configuration. Necessary consulting at organizational and technological levels remains high despite radical reduction in actual hardware costs. Also training costs remain high. Costs have also been cited in previous literature as well as sources of dissatisfaction. (See Soliman & Janz, 2004) However, for trust creation, costs also create reasons to develop relationship further. The fact that in order to develop relationship, you have to incur costs motivates management to invest in relationship. Without relationship specific investment, management might have fewer incentives to actually develop the relationship further. In this sense, the high cost of implementing interorganizational systems may allow companies to deepen their relationship. Relationship specific investments into interorganizational systems are sunk costs, in a sense that they are not recoverable, if the relationship fails.

All components of trust (capability, goodwill, behavior and self-reference) has seen improvement during relationships life time. Both respondents saw also improvement after interorganizational system implementation. However, based on two interviews that have done three years after interorganizational system have been implemented, it is infeasible to conclude that the level of trust between companies has truly increased. It is also under uncertainty what part of improvement can be attributed to interorganizational information system. In order to truly access the effect, we would have to have longitudinal study encompassing several years both before and after implementation.

Companies' respondents considered similarity of values and culture to be important consideration. Shared values and shared history was cited by both parties as important source of co-operational capacity. Orfer is a family owned company and Rocla has been family owned company in the past. Similarity of ownership structure has made it easier for both companies to communicate with each other. Today Rocla is no longer family owned, but traits of family ownership are still affecting their culture. Company representatives also considered that rough times during early '90s when Finland

experienced severe economic distress also contributed into understanding the value of co-operation. Both companies had economic difficulties during that time and this shared experience allows them to communicate with each other.

8 Summary

The relationship between trust and its components is fuzzy from theoretical point of view. It is also unclear how changes in dimensions and their relative levels affect trust. It is also unclear how asymmetry of trust affects trust creation process. These uncertainties at theoretical level make it difficult to draw definite results. It is important to note as well that trust is intangible. It does not have any "real" physical component. If it exists, it exists in patterns of information between abstract entities.

Existing research concerning both interorganizational information systems and trust has strong tendency to regard trust as a function of information technology; meaning that trust is for example seen as a capacity for system to maintain secure connections. Trust is also usually seen from rather narrow perspectives and it is often only mentioned with few lines at best. It is rarely, if ever truly under investigation. The lack of trust literature concerning interorganizational information systems is surprising considering that the lack of trust seems to be one of the main reasons for failure of both implementing interorganizational systems and then actually receiving "promised" benefits. Trust has long been an issue both in supply chain (see Whan et al., 2004) literature and in strategic management literature (see Ring and Van De Ven, 1992). Trust acts in supply chain as a facilitator connecting various subsystems of supply chain network and allowing deeper interorganizational operational capacity to emerge. Trust's role has been acknowledged at interorganizational level and at personal level as well as between organizations. (Arino, Africa at al., 2005)

Trust exists at one level at the heart of strategic management (See Joni, 2004 and Ring & Van De Ven, 1992). Trust has many interpretation and many linkages into other theoretical (and practical) constructs. This complexity makes it difficult to produce any simplified picture that would still adequately capture its' inherent complexity and would still be useful. Trust is also utilized in existing literature in conflicting ways depending on context and researchers' opinions and views of the universe. In short, trust is very context sensitive concept. A concept that is sensitive to opinions and view points is problematic in a sense of scientific ideals because it has inherently low validity.

This study has sought to combine information systems research with trust research. Understanding has also been sought from transaction cost economics. The combination of trust research and interorganizational information systems is very rare in literature. Both have been widely studied

separately. This study has combined components of trust model by Blomqvist (2002) with Childs' (2001) research in how trust evolves between organizations over time. This has then been applied on a dyadic relationship between two industrial companies to study how their use of interorganizational information system has evolved over time.

Study contains literature review on trust and interorganizational information systems. Furthermore, the framework was capable of producing meaningful results that to a great extent agreed with previous theoretical and empirical literature. The causality that trustful relationship improves use of ICT and that eventually leads into extensive use of interorganizational information system cannot be established with this study. However, the issue of causality was not under study. Rather, the attempt was to explore the role and function of both trust and interorganizational information systems. In theoretical part it was shown that trustful relationship can lead into increased investment into interorganizational information system. Interorganizational information systems can then increase trust between organizations.

For managerial practice the contribution is that management should explicitly recognize trustful relationship as important aspect of development of interorganizational information systems. Furthermore, trust should be managed and developed. Components of trust (Blomqvist, 2002) seem to be valid. The framework could serve at least as a starting point for trust development. Also trust's various dimensions from personal level into organizational should be recognized and developed accordingly. It is also important to recognize time dimension of trust. Trust does not remain static over time. It is important to be able to recognize various differences in trust in order to be able to use it successfully as a coordination mechanism. Also, it seems reasonable to assume that the interorganizational information system can contribute into the development of trust at least in the calculative phase (Child, 2001). At later stages, information systems could function as an institutionalized repository of information that could then support trust formation and maintenance. Organizations would be capable of maintaining information in easily retrievable fashion in order to facilitate information exchange and processing. This view would largely be compatible with Knowledge Management in that sense that trust could be seen as institutionalized into information systems and then these could be considered as something similar with Cyber Ba (Nonaka & Konno, 1998). In addition, the cost of interorganizational information system can be considered as relationship specific investment that can give management basis for further development of relationship. If the relationship fails, investment is lost (somewhat similar to hostage taking). The possibility of monetary loss would then act as a stimulus for management both to develop and

maintain relationship. In addition, trust itself seems to create trust. This also holds with distrust. Trust creates trust in the whole network and this potentially leads into better relationship. Better relationship leads into trust creation. This again may allow companies to invest more into relationship specific capital that can contribute to lower costs by allowing companies to invest into capital goods that offer superior returns compared to capital goods that are not relationship specific. Improvement in trust may allow companies to reap abnormal profits.

Trust could offer software companies new ways to compete in the business software market. Software companies could achieve competitive advantage by developing superior understanding of trust and how it is created and maintained by interorganizational information systems. The market for "trust friendly" software could be surprisingly high. Trust is a human centric concept and by moving into increasingly "trust friendly" direction, software company could position itself as a good, caring corporate citizen that takes good care of its' business eco system.

At the moment, people are raising questions concerning both globalization and perceived injustice of economic development. Many people are questioning the current economic trend that emphasizes the use of free market as a coordination mechanism. This "hard" approach for business system coordination could be "softened" by increasingly "trust friendly" approaches to business. By utilizing more "trust friendly" measures, companies could soften their impact into their environment and therefore contributing to the creation of social capital. This could also reduce discontent to current practices at low cost.

9 Limitations

Study studies trust and its' effect on interorganizational information systems. Study is based on two interviews. Trust development happens over number of years. It is a slow process. In order to fully assess trust development, study should be longitudinal, spanning over several years both before implementation of interorganizational information system and after it has been implemented. This would allow researcher to assess relationship over number of years both before and after. This study was limited by respondents' memory and experience. Both respondents had deep experience in their respective companies and this helped considerably but longitudinal study would still provide higher quality results.

Results were also based on one relationship between two companies. Quality of results would improve if number of studied relationship would be higher. This would allow researcher to compare results from greater sample and company idiosyncratic issues could be eliminated. Case companies also had similarity in their cultural background. Both were Finnish companies with similar historical evolution patterns, similar attitudes toward information technology and there were also similarities in value structures and attitudes. How would results change if these similarities did not exist? The effect of cultural distance in trust creation was beyond the scope of this study, but it is nevertheless important consideration when interpreting results because companies have to be capable of doing business with increasing amount of cultural differences due to globalization of business environment. Often it is infeasible to expect that companies to share values or other cultural conventions in any large scale. This obviously makes intercultural communication an important part of interorganizational communication process. One cannot expect the other party to see things in similar light in international context.

McCoy et al. (2005) have evaluated different aspects of national culture and how to model it. These issues are also important for trust because trust is a social phenomena and it is obviously moderated by cultural issues. However, cultural distance is beyond the scope of this study. Researcher decided to exclude cultural distances because selected case companies were both Finnish companies and cultural distance would not be an issue without international business context. The complexity of adding cultural distance into research agenda would necessitate research efforts far beyond the capacity of researcher.

Theoretical understanding of trust is still an issue in a sense that it is in literature understood in number of ways that are very context specific. This limits both theoretical generalization and it also makes it difficult to give unambiguous advice to practical managerial problems. Trust is not an absolute concept like mass (m). It cannot be measured directly. One has to observe it indirectly from patterns that emerge in relationships. This observation is naturally very error prone due to the nature of trust.

10 Future Research

Trust and its' relationship with interorganizational information systems is a field that has received limited attention. There are many topics that are worth studying in trust research. In this discussion trust refers to trust in dyadic relationship between two companies.

At theoretical level, the relationship between trust and transaction cost economics remains an interesting topic (Blomqvist et al., 2000). Especially, the connection with trust and relationship specific investment is interesting. Information systems are usually not designed with the explicit goal that they would help in creation of trustful relationships between companies. However, due to the complexity of relationships and the fact that companies are highly dependent on their relationships, one might wonder if it is appropriate to "forget" the need for information systems to contribute into actual relationship creation and maintenance. A question can be raised to what kind of (interorganizational) information system is beneficial for trust creation and how trust aspect could be best implemented into information systems. In today's demanding software business, it is conceivable that a software company could attain competitive advantage by being able to understand trust better and then by implementing trust friendly information systems, it could actually deliver real value to its' customers; value that would be difficult for its' competitors to replicate without similar understanding of trust. As research question this could be formulated as:"What kind of features is important for trust friendly information systems?"

Theoretical understanding of trust still has room for improvement. Assuming that components of trust model is valid (Blomqvist, 2002), one might start by asking what are the relative importance of these components and over what circumstances they vary and how. In order to manage and develop trust, it would help if we had methodologies to measure trust. Moreover, a methodology to measure trust that could be programmed into interorganizational information system would be valuable for practicing managers. This would allow management directly to assess trust and how it has evolved over time. Also it would assist management greatly if it was feasible to develop decision support systems that would be capable of producing intelligent advice on how to best improve trust. In order for trust to be really useful concept, it has to be linked with company's strategy in such a way as to allow both strategy and trust to co-operate. Trust without corporate strategic dimension is a rather shallow idea. Trust could allow companies to better fulfill their dreams and visions. This dream like

quality is what makes trust such an interesting concept. Trust could allow companies to plan at a level where they can forget many details and this could allow companies' and their management to achieve better clarity in their strategic planning process. Trust could also be considered as a relative "human friendly" concept that is at least to some degree intuitively clear. Trust concept could also allow human's to bond and also reduce their stress levels. The connection with trust and employee stress level would be an interesting topic for researcher that is interested in organizational studies/psychology.

Trust capitalizes relationship, and it is generally seen as a positive from many perspectives. However, does trust has negative side where it actually reduces performance and value and when this happens? Can trust be utilized as a tool for extortion like behavior where it is utilized to force other companies/stakeholders to adopt positions that are not reasonable and what kind of remedies could be utilized to correct this "misuse of trust". In order to develop relationship, is it possible to develop framework to assess "optimal" level of trust in given circumstances. In this approach, trust would probably have to be linked with strategy in one way or another. Trust at corporate level cannot be seen outside of strategy because it unavoidable enters into a field that is very close to traditional strategic management literature. The connection between trust and strategy seems to be very fundamental phenomena (see Ring and Van De Ven, 1992). From strategic management, one can see that concepts like strategic information systems are very close to each other.

Networks (hybrids) and markets are at least to some extent alternative structures. Interesting theoretical research can be conducted in how governance systems move from hierarchical into perfect markets. Networks would lie somewhere in the middle. Excessive trust can decrease market efficiency by increasing switching costs? Does this increase or decrease company performance? (When and over what performance metric) Trust can also bind company into extended network. The actual commitments become difficult to assess because they are not contractual in nature. This might increase risks and make risks associated into the extended network difficult to assess. Does trust lead into reduction or increase in risk when you take account the extended network?

This study was conducted under assumption that trust is not affected by intercultural issues. This assumption is very limiting in that companies operate increasingly in international business environment where cultural distance is an everyday fact. Interesting topic would be to extend trust concept into international context. Case companies had somewhat similar background and they did not experience any cultural distance that can be compared with companies that would operate in

environments where cultural differences would be much larger. The development of theory into direction where it would be applicable in international environment would increase its' applicability considerably.

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12 Appendix A: Interview Questions

XXX=the other company in relationship

Background Information

Respondent

- What are your current duties and what is your job title?
- What is your educational background and work experience?

Company related

- How large is your company (revenue, personnel)?
- How you would describe your company's position in value chain?

Partner related (in network)

- How large is your partner company XXX?
- What is their role (XXX's role) in your company's supply chain?
- How they (XXX) perceive your company's role in their supply chain?
- With what department/person you mainly are dealing with XXX?
- How old is the relationship between your company and company XXX?

Relationship (General level)

- How you would describe the relationship between your company with XXX and how it has developed over time?
- Do you have communication plan that deals with communication with partner company XXX?
- Do you actively manage learning process between you and XXX? (Knowledge management)
- Do you have active efforts to develop and maintain relationship to XXX?
- Do you periodically assess your relationship and how it has developed with XXX?
- Do you have plans (goals) for your relationship with XXX?

Contact person/s

- How much there is communication between your company and XXX?
    - Number of persons involved
    - At management levels
        - top management
        - middle management
        - experts
        - operational personnel
    - What is the extent of communication
        - demand information (demand of end product/service)
            - estimated demand (time horizon)
        - supply information (components)
        - Stock levels
        - Do you have
            - meetings (regular, how often?)
                - at what management level
                    - how many participants (who, responsibilities?)
            - e-mails
            - phonecalls
            - Shared information systems
                - ERP
                - e-commerce
                - shared extranet
                    - Excel sheets
                    - Mathematica, Matlab tiedostot
                    - Power point slides
                    - CAD/CAM
                    - Decision Support Systems
                    - Groupware
                    - Knowledge management

- Time dimension
  - long term planning
  - Short term, demand and availability
- What kind of is the relationship to partner company in terms of trust both at personal and company level? How has these **evolved over time**?
  - Capability
    - Technological capability
    - Business capability
    - Capability to co-operate
  - Goodwill?
    - Moral responsibility and ethical approach
    - Positive intentions:Interest, care and concern, understanding, respect (equity)
  - Behavior
    - Sociability, open communication
    - Follow-through promises, integrity
    - Learning, adaptation, commitment
  - Self-reference
    - Identity: Clear values and culture
    - Mature perception of capabilities

Information Systems

- What kind of information systems are you using?
- How do you communicate with your partner company?
  - in addition to previously mentioned
- How has this changed over time?
  - What do you see is the role of information technology?
  - Have you increased/decreased use of information technology?
  - Are you satisfied with your information systems and how your perceptions of information systems have changed?
  - How much experience your company has with information technology?

13 Appendix B: Haastattelu kysymykset suomeksi

XXX=liikesuhteen toinen osapuoli

Taustatietoa

Vastaaja

- Mitkä ovat teidän tämän hetken tehtävänne ja mikä teidän tehtävänimikkeenne?
- Millainen on koulutuksenne ja työkokemuksenne?

Yritykseen liittyvät

- Kuinka iso tämä yritys on(liikevaihto, henkilömäärä)?
- Miten kuvailisitte yrityksenne sijaintia arvoketjussa?

Yhteistyökumppaniin liittyvät

- Kuinka iso on yhteistyökumppaninne (XXX)?
- Mikä on heidän roolinsa yrityksenne arvoketjussa?
- Miten yhteistyökumppaninne näkee teidät omassa arvoketjussaan?
- Kenen kanssa (osaston/henkilön) kanssa pääasiassa työskentelette yhteistyökumppaninne kanssa?
- Kuinka monta vuotta vanha on liikesuhteenne XXX kanssa?

Yhteistyösuhde(Yleinen taso)

- Minkälainen on suhteenne XXX yrityksen kanssa ja miten se on kehittynyt ajan kuluessa?
- Onko teillä kommunikaatiosuunnitelma joka käsittelee kommunikaatiota XXX yrityksen kanssa?
- Johdatteko aktiivisesti oppimisprosessia teidän ja XXX yrityksen välillä? (Tietojohtaminen)
- Pyrittekö aktiivisesti kehittämään ja ylläpitämään liikesuhdetta yritys XXX:n kanssa?
- Arvioitteko säännöllisesti suhteenne yritykseen XXX ja kuinka se on kehittynyt?
- Onko teillä suunnitelmia(tavoitteita) liikesuhteellenne yritys XXX kanssa?

Yhteyshenkilö(t)

- Kuinka paljon teillä on kommunikaatiota yritystenne välillä?
  - Montako henkilöä on osallisena
  - Millä organisaation tasolla
    - ylin johto
    - keskijohto
    - asiantuntija
    - operatiivinen henkilökunta
  - Kommunikaation määrä
    - kysyntä informaatio (lopputuotteen/palvelun kysyntä)
      - arvioitu kysyntä (aika)
    - tarjonta informaatio(komponentit)
    - Varastotasot
    - Onko teillä
      - tapaamisia(säännöllisiä, kuinka usein?)
        - millä organisaation tasolla
          - kuinka monta osallistujaa (kuka, vastuualueet?)
      - sähköposti
      - puhelin
      - jaetut informaatio järjestelmät
        - ERP
        - elektroninen kaupankäynti
        - extranet
          - Excel sheets
          - Mathematica, Matlab tiedostot
          - Power point kalvot
          - CAD/CAM
          - Päätöksenteon tukijärjestelmät
          - Groupware
          - Knowledge management
  - Aika
    - pitkän ajan suunnittelu
    - lyhyen ajan, kysyntä ja saatavuus

- Minkälainen on suhde yhteystyökumppaniinne luottamuksen suhteen henkilökohtaisella ja yritys tasolla? Kuinka nämä ovat kehittyneet ajan suhteen?
    - Kyvykkyys
        - Teknologinen kyvykkyys
        - Liiketoiminnallinen kyvykkyys
        - Yhteistyökyky
    - Hyväntahtoisuus
        - Moraalinen vastuullisuus ja eettinen asenne
        - Positiiviset aikeet: kiinnostus, huolenpito ja välittäminen, ymmärrys, kunnioitus (oikeudenmukaisuus)
    - Käyttäytyminen
        - Seurallisuus, avoin kommunikaatio
        - Vastaa lupauksistaan, rehellisyys
        - Oppiminen, sopeutuminen, sitoutuminen
    - Itse tuntemus
        - Identiteetti: selvät arvot ja kulttuuri
        - Omien kykyjensä tunteminen

Informaatio järjestelmät

- Minkälaisia tietojärjestelmiä teillä on käytössä tällä hetkellä?
- Kuinka kommunikoitte yhteistyökumppaninne kanssa?
    - aikaisemmin mainittujen lisäksi
- Kuinka tämä on muuttunut ajan kuluessa?
    - Mikä teistä on informaatioteknologian rooli?
    - Oletteko lisänneet/vähentäneet informaatioteknologian käyttöä?
    - Oletteko tyytyväisiä informaatiojärjestelmiinne ja miten teidän näkemysenne informaatiojärjestelmistä on muuttunut?(Niiden roolista liiketoiminnassanne)
    - Kuinka paljon yrityksellänne on kokemusta informaatioteknologiasta?

14 Appendix C: Luottamus ja tietojärjestelmät

Tutkimuksen tavoitteena on parantaa ymmärrystä luottamuksen ja tietojärjestelmien vuorovaikutuksesta. Tutkimus käsittelee miten tietojärjestelmät vaikuttavat luottamukseen **yritysten välisissä suhteissa**. Yritys nähdään tutkimuksessa osana **yritysverkostoa (arvoverkosto)**. Yritys on myös osa omaa arvoketjuaan. Tutkimuksen teoreettinen tausta on luottamustutkimuksessa yhteiskunta ja taloustieteen eri traditioista. Tutkimuksen empiirinen lähestymistapa on case tutkimus.